FLIGHT

The AIRCRAFT ENGINEER & AIRSHIPS

First Aero Weekly in the World

Founder and Editor: STANLEY SPOONER

A Journal devoted to the Interests, Practice, and Progress of Aerial Locomotion and Transport

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DIARY OF FORTHCOMING EVENTS.

Club Secretaries and others desirous of announcing the date of important fixtures are invited to send particulars for inclusion in the following list:

Feb. 28 ...	Lecture by Mr. Handley Page, C.B.E., at King's College, Strand, at 11 a.m.
April 18 to May 2	Seaplane Competition at Monaco
May 22 and 23	Aviation Competition at Juvisy in connection with Fêtes de Paris
June 1 ...	Air Ministry Competition (Small Type Aeroplanes), Martlesham Heath
July ...	S.B.A.C. International Aero Exhibition at Olympia
July (mid.)	Seaplane Contests at Antwerp
Aug. 1 ...	Air Ministry Competition (Seaplanes) Felixstowe
Aug. (end of)	Schneider International Race, Venice.
Sept. 1 ...	Air Ministry Competition (Large Type Aeroplanes), Martlesham Heath
Sept. (end of)	Gordon-Bennett Aviation Cup, France.

EDITORIAL COMMENT

THE Air Ministry and the few firms actively engaged in civil aviation enterprises are to be congratulated on the issue of a plain statement of the work covered by the period from May 1 to December 31 last. It records not only the actual number of flights accomplished, but the number of hours flown and the approximate mileage covered. It also gives a return of numbers of passengers carried, weight of goods transported, and casualties suffered by machines and passengers. Only by the periodic issue of such statements as this can the public be brought to a proper realisation of the fact that aviation has even now taken its place as a regular means of transport, and, what is much more important even than that, a safe means of travel as well.

Civil Air Traffic Returns

A brief analysis of the figures will demonstrate this. We find that in Great Britain and on the Continental routes 403 machines were in use; 35,330 flights were made, and 8,368 machine hours were flown, the mileage totalling about 593,000. The number of passengers carried was 64,416 and the weight of goods conveyed was 67,143 lbs.

That, we submit, is not at all bad for seven months' work at a time when commercial aviation is only just beginning to feel its feet, and when nothing in the way of the State assistance has been forthcoming to which the industry has been induced to look for its initial send-off.

Few people will have realised that with the few services in active operation aviation could really have attained to such performances as are set forth by the return, and we cannot help feeling that the record is eminently satisfactory, and must be pleasing to those who have had the pluck to carry on when all the circumstances are taken into account. It should have been far more satisfactory to those who view the development of commercial aviation as vital to the interests of the State, and it would have been had it not been for the quite unsatisfactory attitude of the Executive towards the subject.

However, that is a matter to which we have made repeated references, and we can only say now that the report is good so far as it goes.

Accidents and their Causes

We find from the figures supplied that there was a total of 18 accidents during the period covered by the returns. Of these four resulted in the death of one or more occupants of machines. Eight caused non-fatal accidents to persons riding in machines. One accident caused the death of a third party, and five were unattended by injury to individuals. Analysis shows that there was one accident to every 32,900 miles flown, and that the time flown per accident was about 465 hours. One accident per 1,960 flights happened—a very fine demonstration of the safety of aerial travel. If we take the number of fatal accidents for purposes of comparison, we find that one person was killed for every 100,000 miles flown. We doubt if any other method of transport can show better figures than these.

At least two of the recorded accidents can be properly classed as avoidable. One was due to the jamming of *aileron* controls, which certainly ought not to happen if the design is right in the first place and frequent inspection is properly insisted upon while the machine is in use. The second avoidable accident seems to have been caused by a back-fire from the motor causing the ignition of petrol vapour in the cockpit of the machine. Proper placing of the petrol tank and the provision of suitable gauzes in the induction manifold would seem to be called for in the case of machines of this type.

The greater proportion of accidents were caused by engine failure. Six cases were recorded, and it must be said that so small a number, averaging one to every 100,000 miles flown, is not at all a bad record. Still, we have always to keep in mind that we are striving for that relative perfection in engine design and construction which shall ensure that there shall be no failures at all. We doubt not that this high degree of reliability will be reached before long. Obviously the record indicates that already we are within measurable distance of it now, so there need be no misgivings on the score of what we may term ultimate reliability of the motor. In this connection it would have been interesting to have known the precise causes of such failures as are disclosed in the returns. It would have been valuable to have learnt whether such failures were due to ignition trouble, valve breakages or other valve defects, or defects in the petrol system. If we were to hazard a guess we should say that the greater proportion were due to ignition failure, but as to that the returns say nothing.

Two accidents were caused by errors of judgment on the part of pilots, and a similar number to weather conditions. Unintentional interference with the dual control caused one accident, while one of the recorded fatalities was caused by a pony-trap crossing the line of flight as the machine was leaving the ground. The really unavoidable accidents seem to have been those caused by errors of judgment and by weather conditions. It is perfectly obvious that however inherently safe any method of transport may be, there is always the human factor to be taken into account. It does not matter whether the mode be railway or steamer, motor car or aircraft, there must always be present a certain, almost infinitesimal, danger from failure of the human mechanism. The railway signalman pulls a wrong lever and an accident happens involving, possibly, the loss of a score or more of lives. The officer in charge of the bridge on a liner miscalculates and gives a wrong helm order, with the result that collision occurs and a fine ship is sent to the bottom. The driver of a car underestimates his speed at a corner and piles his car up in a field. So in the case of aircraft, it is impossible to eliminate the factor of human judgment, and if we get rid of every other cause of accident that must still be present. But how really small a quantity this is may be very adequately judged by the statistics with which we are dealing, and which show that there is actually one error of judgment involving accident to a machine—not necessarily fatal or even accompanied by personal injury—for every quarter of a million miles flown. If anyone wants a safer means of transport than is connoted by this essentially simple fact, well, he will have to look for it elsewhere than on this very imperfect planet.

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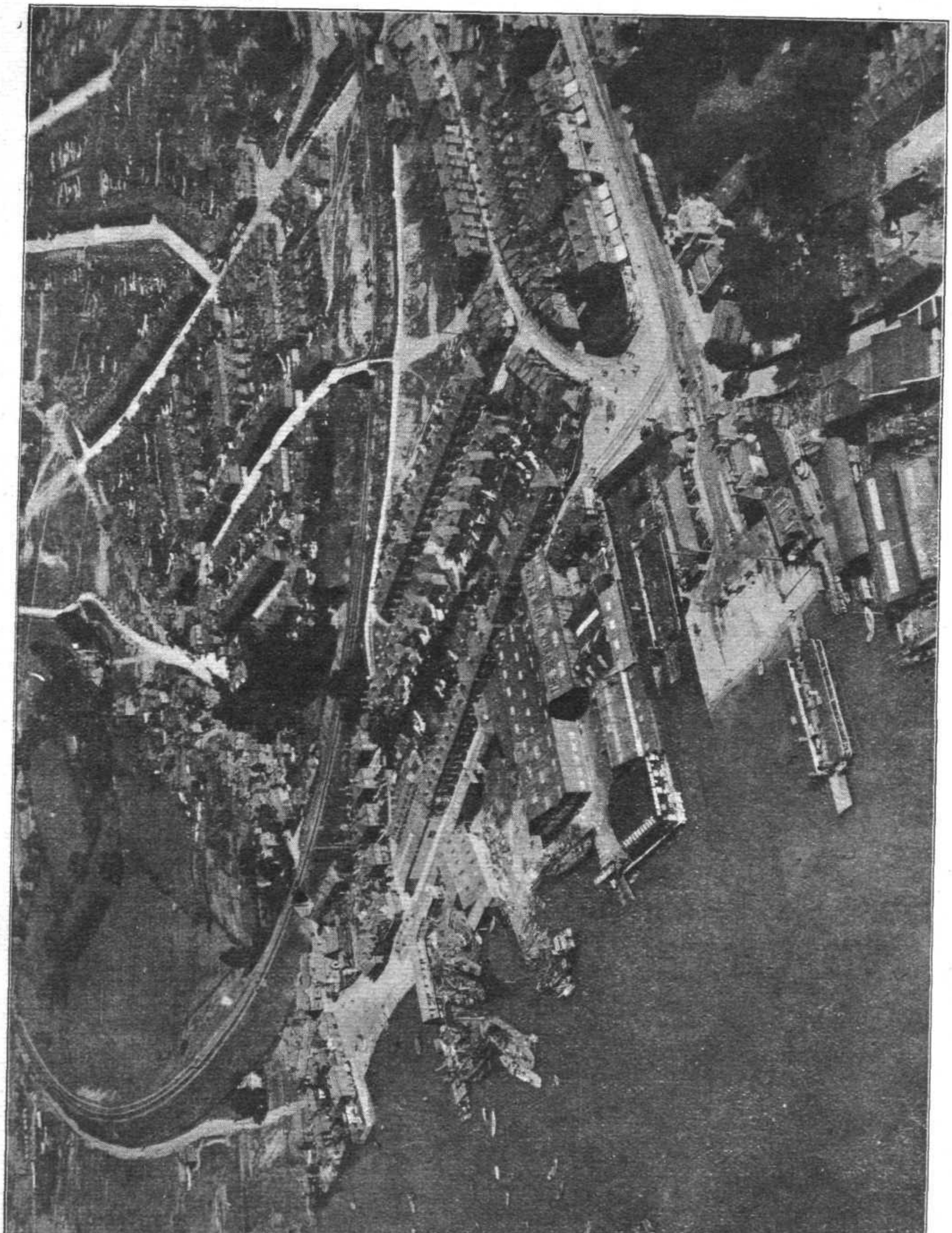
The Price of Petrol

At a time when commercial aviation is striving to keep its head above water and to place aerial services on a remunerative basis, the price to which fuel has soared is an exceedingly serious matter for the industry. The recent findings of the sub-committee appointed to investigate the subject, under the powers delegated to the Central Profiteering Committee, have resulted in the considered statement that there is no justification for the continual upward trend of prices, and that there is no reason why the cost of petrol should be morethan 2*s.* 10½*d.* per gallon retail, and that of benzole 2*s.* 8½*d.* per gallon. There is some reason for the belief that certain members of the sub-committee were in favour of declaring that the proper price should be in the neighbourhood of 8*d.* per gallon less than the figures given above. Unfortunately, it is quite impossible for the Government to take effective action to regulate the prices charged for motor fuel. The moment anything of the kind was attempted there is no reasonable room for doubt that all motor fuel would disappear from the market, and would go to other countries where people are prepared to pay the extortionate prices demanded by the get-rich-quick combines which control supplies. So that we are faced with the position that while it is essential to the proper development of transport, land and aerial, that a plentiful supply of motor fuel at a cheap price should be available, costs are soaring out of sight, and the end has not, if we are not misinformed as to the intentions of the trusts, come yet.

We confess that the remedy seems far to seek. Development of home sources of supply is one way out of the difficulty, but it is obvious that this cannot be done in a day or a year. There is a remedy, if it can be applied, and one that we think would result in almost immediate relief. It is this: apply the principles of the League of Nations to what is really a vital matter for the world's transport. Now, there are but four, possibly five, countries in Europe which are really petrol users. Britain, France, Italy, and, to a smaller extent, Spain, are those we have in mind. Germany normally uses a great deal of motor fuel, but her circumstances are such now that she may be left out of the argument without affecting the position. We know that if we refuse to pay the prices demanded by the trusts we shall get no petrol, and that it will all go to the other countries we have named. Therefore, it is useless for our own Government alone to attempt to control prices; but what if all the countries involved in the trust operations fixed a common price? The Profiteering Committee finds that the price is too high, and that it should not exceed

The Camera and the 'Plane



Southampton Ferry as seen from a Supermarine Flying Boat

"Flight" Copyright

2s. 10½d. per gallon. All the Premiers of these countries are meeting in London, and what more easy and natural than for them to agree that the cost of fuel must not exceed that figure or its equivalent? This is not at all a question of simply securing cheap petrol for the motorist or the aviator for pleasure use. As we have said, the whole development of transport depends on the supply of fuel at a commercial price. The case of every country is identical with each of the others, and it does seem to us that this is a matter in which common action to a single end would be effective and simple. There may possibly be some defect in the idea which is not apparent on the surface, but we confess we do not appreciate where such a defect can lie. If there is none, or if the idea is at all within the bounds of practical politics, some such action should certainly be taken. We are not out for depriving even a trust of a legitimate commercial profit on its transactions, but in a case where exhaustive enquiry has demonstrated beyond all possible doubt that Europe is being flagrantly profiteered on its fuel, collective action for the reduction of inordinate profits seems to be the only remedy which can be applied with any prospect of success.

CIVIL AVIATION

THE Air Ministry makes the following announcement: Returns supplied voluntarily by civil aerial transport firms in the United Kingdom for the period May 1 to December 31, 1919, show that for Great Britain and on the Continental route 403 machines were in use, 35,330 flights were made, and 8,368 machine hours were flown, the mileage totalling approximately 593,000. The number of passengers carried was 64,416, and the weight of goods carried amounted to 67,143 lbs.

The following figures show the proportion of accidents over the whole period:—

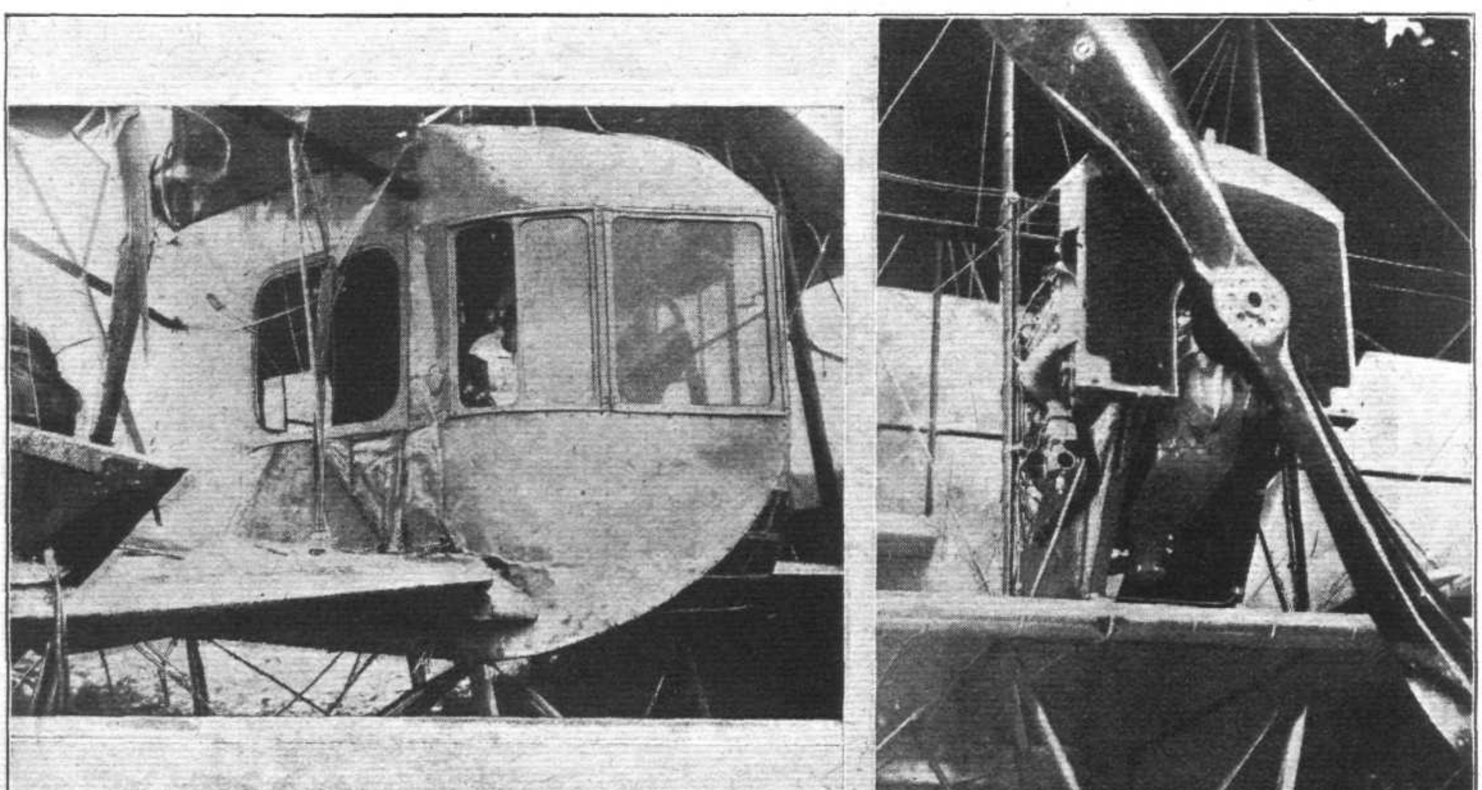
Accidents resulting in death of one or more occupants of machines	4
Non-fatal accidents resulting in injury to occupants of machines	8
Accidents resulting in death of third party (occupants of machine uninjured) ..	1
Accidents in which no one was killed or injured	5
Total accidents reported	18
Approximate number of machine miles flown per accident..	32,900
Approximate number of machine flights per accident	1,960
Approximate number of machine hours flown per accident..	465

The most common cause of accident was engine failure, of which there were six cases. An error of judgment on the part of the pilot and weather conditions were responsible for two accidents each, and the following facts were each responsible for one: Unintentional interference with the dual control; jamming of the *aileron* control; the ignition of the petrol in cockpit by back fire; a pony-trap crossing the line of flight as the aeroplane left the ground. One case was not definitely determinable, and three cases were not investigated. The mishaps due to the jamming of the *aileron* control and engine failure show the necessity for very close daily inspection by aircraft owners.

During the period under review four pilots were killed and six injured, and one passenger was killed and 10 were injured; a third party being killed by the pony-trap accident referred to above. The percentage of casualties was as follows:—

Pilots killed per 1,000 flights made by pilots	0·11
Pilots injured per ditto	0·17
Pilots killed per 1,000 hours flown by pilots	0·48
Pilots injured per ditto.	0·72
Pilots killed per 1,000 passengers carried	0·016
Passengers injured per 1,000 passengers carried	0·16
Passengers killed per 1,000 hours flown by passengers	0·06
Passengers injured per 1,000 hours flown by passengers	0·61

It should be noted that the above figures do not include the flights to Australia for the £10,000 prize offered by the Commonwealth Government.

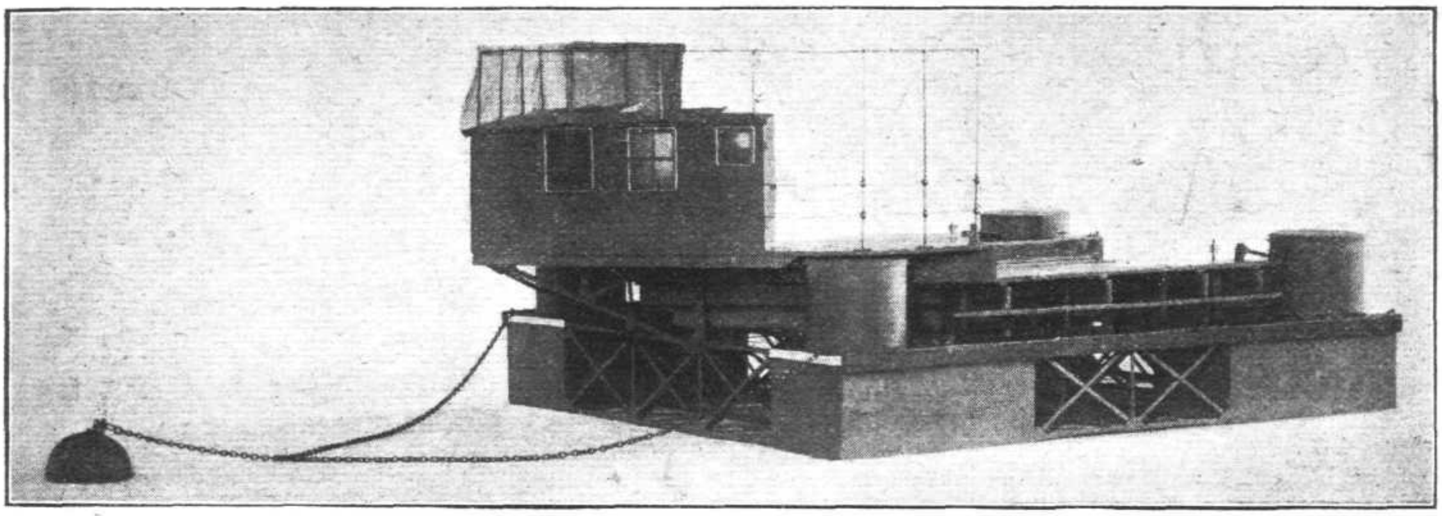


A battle-stained Sikorsky biplane, which returned with 374 bullet and shrapnel holes in it, and a front strut shot away. On the left a view of the cabin, and on the right the damaged radiator of the 150 h.p. Sunbeam engine

BRISTOL MOORING PONTOON FOR HYDRO-AEROPLANES

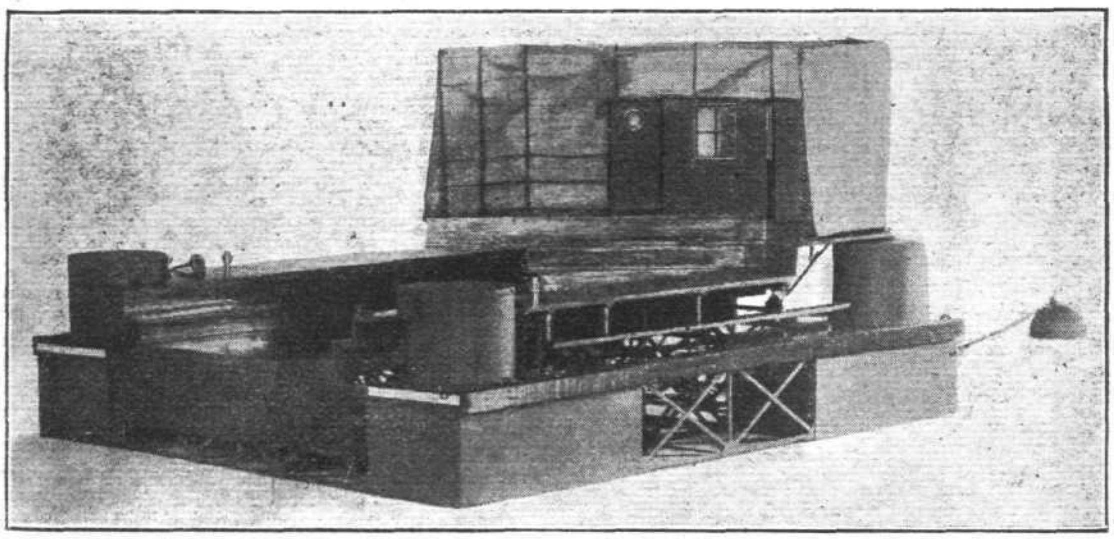
ONE of the exhibits of the British and Colonial Aeroplane Co., Ltd., at the recent Paris Aero Show was an interesting model of a pontoon or floating dock for the mooring of hydro-aeroplanes. One of the difficulties encountered with hydro-aeroplanes and flying boats is their mooring when not in use, especially in rough weather. If moored to a floating buoy they are at the mercy of the waves and liable to considerable damage, and even when pulled on to a slip, the process of doing so is not without difficulty and danger. It is with a view of overcoming these difficulties that the pontoon in question was designed. Briefly, it is a small floating dock, which is itself moored to a buoy, so as always to be kept head to wind, and upon which the machine is "docked." This tanks reach above the water level. It is so arranged that it will still be possible to sink the pontoon whether the petrol tanks are full or empty, the system under either condition remaining completely stable.

The superstructure of the pontoon is made of timber. Planking is arranged on top of the lattice-work girders connecting the ballast tanks, thus forming a deck on which to rest a cradle or other means of support for the flying boat, and from which the boat can be handled. When the pontoon is raised this deck is located immediately above the water-level. A step-up from this lower deck leads to two running decks fitted longitudinally between the petrol tanks, thus forming a convenient position from which the flying boat



The Bristol mooring pontoon for hydro-aeroplanes

arrangement has the advantage that the hydro-aeroplane or flying boat can be handled with ease and quickly brought in a stable position, even in a strong wind, as the machine can be taxied up to the entrance of the pontoon head to wind and manœuvred into position on the latter, to a certain extent under its shelter. The dock essentially consists of ballast tanks arranged in the corners of the pontoon and connected together by means of lattice-work girders, carrying means for supporting the hydro-aeroplane and a superstructure comprising decks and means for housing the necessary machi- can be handled. When the pontoon is submerged these running decks will be about level with the water-line. Suitable fenders and steps are arranged on the outside of the pontoon in order that boats and lighters may lie alongside, and to provide convenient access for the shipment of goods to and from the pontoon. At the bow end of the pontoon another step-up from the running decks, a V-shaped deck is provided, carried on lattice-work and extending from side to side of the pontoon. This deck will always remain above the water-line. Erected on this deck is a house containing



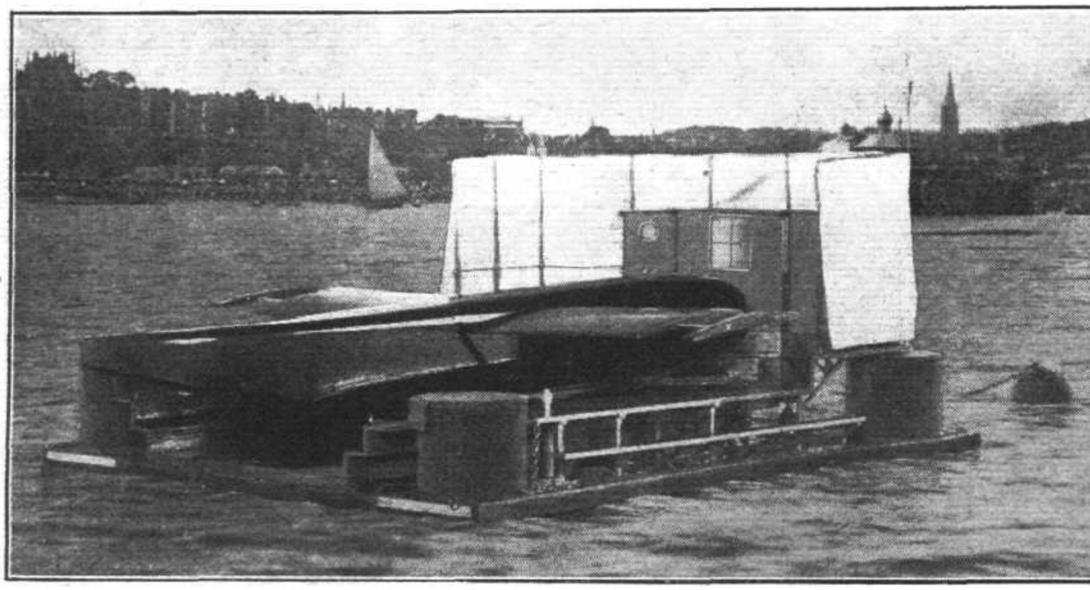
Another view of the Bristol mooring pontoon for hydro-aeroplanes

nery and apparatus. This construction adapts itself conveniently to dismantling the pontoon, when it is to be taken out of the water for repair or storage. These ballast tanks give the necessary buoyancy or lifting power. Standing directly upon them are four cylindrical petrol tanks of the normal type. The load of petrol is really the biggest load the pontoon has to lift, and the petrol tanks are, therefore, placed directly over the ballast tanks. These petrol tanks also serve to give stability to the system when the pontoon is submerged, as even in this position of the pontoon the petrol the necessary machinery and apparatus, and, if necessary, also accommodation for a watchman. A fresh-water tank and a lubricating oil tank may likewise be arranged in a suitable place at the fore end of the pontoon.

In order to keep the pontoon always head to the wind a single mooring is provided in the form of a bridle shackled on to a single chain fastened to a single mooring buoy. Provided on the deck is also a canvas wind screen to help hold the dock head to the wind, and incidentally to protect the flying boat while in dock. With such an arrangement the wind pressure

on the wind screen, unless the pontoon be moored in a place where the current is very strong, would always have the effect of keeping the pontoon head to the wind. If it be necessary to moor the pontoon in a position where there is a strong cross-current, it might be found desirable to drop a couple of kedges, one from each side, at the stern, from which lines could be made fast on the pontoon, which could thus be made to lie in any desired direction.

to receive the incoming flying boat. The latter would taxi up to the entrance at the aft end of the pontoon, and be manhandled on to the cradle, where it would be suitably secured. Compressed air would then be blown into the top of the four lifting tanks from the receiver, and the water driven therefrom, control being maintained by the water valves previously mentioned. These valves are operated by hand levers situated in the house. The pontoon would thus rise, carrying the flying boat with it, which would thus be left high and dry.



The Bristol mooring pontoon as it appears floating on the water, with a flying-boat hull "in dock"

The pontoon is operated by means of compressed air, and for this purpose a small petrol-driven air compressor would be provided in the house mentioned, with the necessary receiver connected by pipes to the ballast tanks. The pontoon would be sunk by admitting water through convenient valves in the ballast tanks. She would then be in a position

The same compressed air plant could be utilised to blow petrol or fresh water on to the flying boat and also for pressing water out of the ballast tanks through fire hydrants preferably arranged on the two aft ballast tanks.

AERODROMES AND LANDING GROUNDS

THE Air Ministry announces that the following Notice to Airmen (No. 16) has been issued :—

The following aerodromes have been added to List A (Service Aerodromes only available for Civilian Aircraft in cases of emergency) :

Aerodromes.	Nearest railway station	Nearest town.
Bedford (A)	Cardington	Bedford.
Oranmore	Oranmore	Galway.

References : (A) Airship Station.

The following Aerodrome has been deleted from List B (Service Stations also available for Civil use) :

Aerodrome.	Nearest railway station.	Nearest town.
Filton	Filton	Bristol.

The following aerodromes have been added to List C (Stations temporarily retained for Service purposes) :

It should be assumed that no facilities usually exist at these stations for dealing with civil aircraft. The aerodromes, however, may be considered as emergency landing grounds.

Aerodrome.	Nearest railway station.	Nearest town.
Barrow (Walney) (A)	Barrow	Barrow-in-Furness.
East Fortune (A)	East Fortune	Haddington.
Killingholme (S)	Habrough	Grimsby.
Polegate (A)	Polegate	Eastbourne.
Pulham (A)	Pulham St. Mary	Harleston.

References : (A) Airship Station ; (S) Seaplane Station.

The following aerodromes have been deleted from List C :

Aerodrome.	Nearest railway station.	Nearest town.
Easton-on-the-Hill	Stamford	Peterborough.
Narborough	Narborough	Swaffham.

LIST D.1.—*Licensed Civil Aerodromes.*

Civilian aerodromes, the licences of which were still in force on February 13, 1920.

Aerodromes at which accommodation exists with the exception of that marked †.

Aerodrome.	Nearest railway station.	Nearest town.
*Hounslow	Hounslow	London.
*Croydon (Waddon)	East Croydon	London.
Brough	Brough	Hull.
Cheltenham (Badgeworth)	Churchdown	Cheltenham.
Cricklewood	Cricklewood	London.
Ensbury Park	Bournemouth	Bournemouth.
Filton	Filton	Bristol.
Hardwick	Lords Bridge	Cambridge.
Hendon	Hendon	London.
†Penshurst	Penshurst	Tunbridge Wells.
St. Annes-on-Sea	St. Annes-on-Sea	Blackpool
Southport (Sands)	Hesketh Park	Southport.
Yeovil	Yeovil	Yeovil.

* Government-owned London terminus. Croydon will replace Hounslow at an early date.

† Emergency landing grounds only. No accommodation.

LIST D.2.—*Licensed Civil Aerodromes.*

Civilian aerodromes the licences of which were still in force on February 13, 1920.

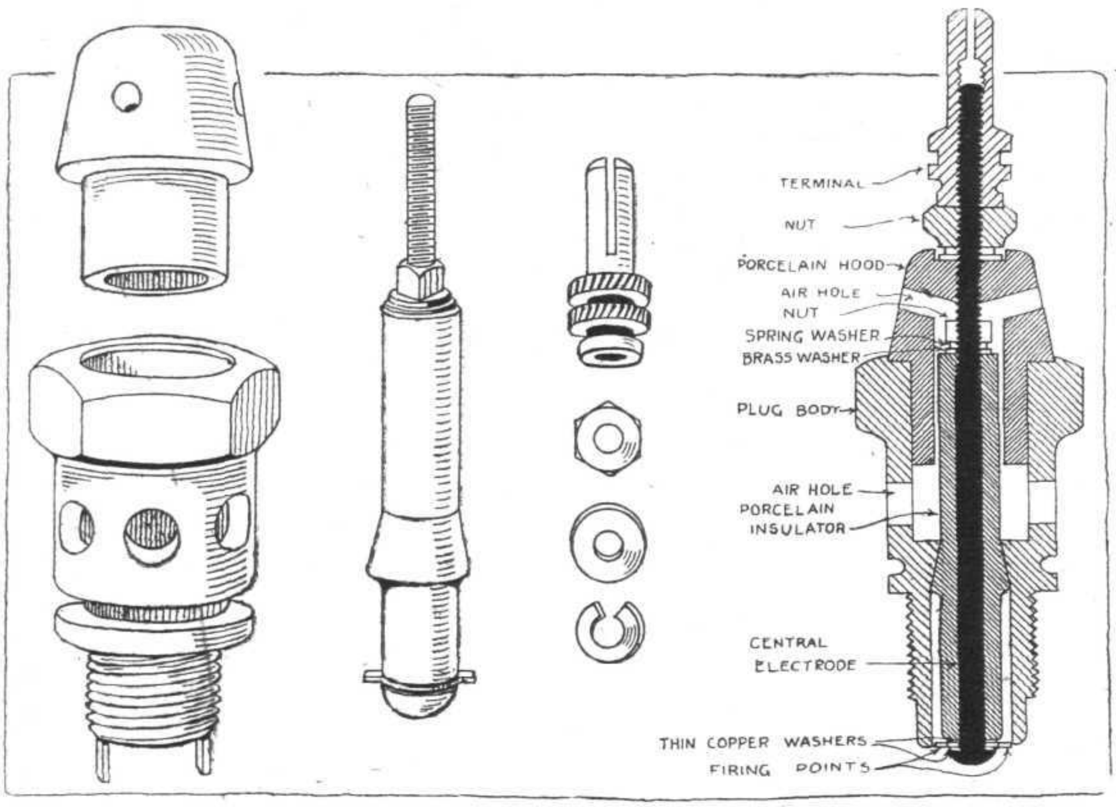
Aerodromes licensed as "suitable for Avro 504 K and similar types of aircraft only." Except in very few instances accommodation does not exist. The licences have also been issued for limited periods only.

Aerodrome.	Nearest railway station.	Nearest town.
Craigentinny	Portobello	Edinburgh.
Derby Racecourse	Derby	Derby.
North Berwick	North Berwick	North Berwick.
Polo Ground, Troon	Troon Junction	Troon.
Rating Lane, Barrow-in-Furness.	Furness Abbey	Barrow-in-Furness.
St. Andrews (Sands)	St. Andrews	St. Andrews.
Uckington (Cheltenham).	Cheltenham	Cheltenham.
West Blatchington	Brighton	Brighton.
Wormwood Scrubbs	Wormwood Scrubbs	London.

AN AIR-COOLED SPARK PLUG: THE MOLLA

At least three sound points are incorporated in the Bougie Molla, which was exhibited at the recent Paris Aero Show by the Société des Etablissements Henry Molla, of 5, Rue Jean Daudin, Paris. First, the provision for air-cooling of the central insulator; secondly, the ease with which it may be taken apart for cleaning and the replacement of any single part; and, thirdly, the means afforded for conveniently regulating the width of the spark gap.

In the Molla plug there are three main parts: (*a*) the body; (*b*) the central electrode with its insulator, and (*c*) the outer porcelain hood. As will be seen from the sketch, the body, of brass, is pierced by a series of holes around its walls which and its insulator is readily dismembered. It consists of a mushroom-headed steel stem, a nickel electrode proper, and a porcelain sleeve. Between the mushroom head and the electrode proper (which is a disc with two large excrescences forming the firing points, at opposite ends of its diameter, and with a hole in its centre to allow the stem to pass through) are a few extremely thin and soft copper washers, with others again between the electrode disc and the base of the insulating sleeve. At the other end of the sleeve is a brass washer, spring washer and nut, by which, when screwed tight on the stem, the separate parts are clamped to form a unit and to seal the possible path of gas-escape between sleeve and elec-



The Molla sparking-plug, shown dissected and, on the right, in section. Its most valuable feature, apart from its being "demountable," is the provision made for keeping cool the central insulator, while another feature is the adjustable spark-gap

lead to a deep and wide annular space surrounding the central insulator. Cold air, entering the holes facing forward, either by the action of the propeller or by the travel of the machine, passes around the insulator, abstracting the heat in its passage, and leaves by the rearward holes. A further series of holes around the outer porcelain hood allow cold air to reach the upper part of the inner insulator, and particularly the junction between this and the stem of the electrode, at which point there is a comparatively large mass of metal where heat would be apt to collect. Two elongated portions of the threaded part of the body form the "earthed" electrodes.

Like the plug itself, the unit comprising the central electrode trode. By partly rotating this inner unit in the body of the plug, the electrode points are brought nearer to or farther away from the "earth" electrodes on the body of the plug.

To prevent leakage of gas between the insulating sleeve and the plug body, the latter is made with a conical portion of its length which fits in a correspondingly shaped seat in the body, a smear of grease being recommended on the coned faces whenever the plug is about to be reassembled. With the outer porcelain hood in place over the top of the central threaded stem, the three main component parts of the plug are unified in a similar manner to that employed for the inner unit.

Pilots Landing at Cranwell

The Air Ministry announces that the following Notice to Airmen (No. 17) has been issued:—

"Machines landing at Cranwell should do so on the southern aerodrome, as part of the north aerodrome is not now available, owing to certain obstructions due to the fact that the aerodrome is now being used as a sports ground."

Office of Inspector-General, R.A.F.

The Air Ministry announces that the post of Inspector-General, R.A.F., held by Air-Marshal Sir G. M. Payne, K.C.B., M.V.O., will be abolished from April 1, and the headquarters office of the Inspector-General at Winchester will be taken over by the Air Officer, commanding Southern Area, R.A.F., from March 1.

Air Navigation School for R.A.F. Officers

The Air Ministry makes the following announcement:—

Arrangements have been made to open a school for the instruction of air navigation at Calshot in April. The course, which will be of 12 months' duration, will be in the following subjects:—Meteorology (advanced), mathematics, general navigation, nautical astronomy, wireless telegraphy, maps and charts, projections, etc.

Each officer successfully qualifying at the end of the course will be granted a certificate stating that he is a qualified air navigator, and will be granted a notation such as A.N. (Air Navigator), which will be decided later, according to the class in which he graduates.

An entrance examination will be held in March, 1920, at which all candidates must qualify for admission to the school. It will cover the following subjects:—

(i) Arithmetic, etc.—Simple arithmetic rules, simple algebraic equations, use of logarithms, elementary graphs, solution of plane triangles in trigonometry, parallelogram of forces, laws of motion, relative motion and gravity.

(ii) General Knowledge.—Simple weather rules from common observation, causes of winds and tides. Causes and dispositions of principal ocean currents and prevalent winds. Movements of celestial bodies. Solar systems. Causes of day and night, seasons, etc.

(iii) D.R. Navigation.—The magnetic compass, its principle and errors. D.R. navigation, including laying off courses and allowing for wind. Map or chart reading.

(iv) Elementary electricity.—Electrical units, simple circuits, primary and secondary batteries. Elementary knowledge of electrical generators.

Candidates for the course must hold permanent commissions.

The Royal Aero Club of the United Kingdom

OFFICIAL NOTICES TO MEMBERS

SPECIAL COMMITTEE MEETING.

A SPECIAL MEETING of the Committee was held on Wednesday, February 11, 1920, when there were present:— Brig.-Gen. Sir Capel Holden, K.C.B., F.R.S., in the Chair, Maj.-Gen. Sir Sefton Brancker, K.C.B., Mr. Ernest C. Bucknall, Mr. G. B. Cockburn, Lieut.-Col. F. K. McClean, Air-Commodore E. M. Maitland, C.M.G., D.S.O., R.A.F., Lieut.-Col. Alec Ogilvie, Lieut.-Col. Mervyn O'Gorman, C.B., Group-Capt. C. R. Samson, C.M.G., D.S.O., R.A.F., and the Secretary.

Flying Services Fund.—The report of the Meeting of the Flying Services Fund Committee, held on February 2, 1920, was received and adopted.

Election of Members.—The following New Members were elected :—

Harold Bolas.
Alexander James Clark (late Capt., R.A.F.).
Francis Thomas Courtney (late Lieut., R.A.F.).
Ronald Eric Dean (late Capt., R.A.F.).
Capt. Robert Halley, R.A.F.
Hubert Geoffrey Battle Linnell.
H. W. Matthews.
R. K. Pierson.
Flight-Lieut. Robert Henry Magnus Spenser Saundby, R.A.F.
Harold Townend.

Temporary Honorary Membership.—Lieut. F. J. Backer (Dutch Flying Corps).
Lieut. Paltke (Dutch Flying Corps).

Competitions.—Correspondence from the Society of British Aircraft Constructors on the subject of Competitions was considered.

It was decided not to proceed with the suggested Competition round England.

It was decided that the Club should organise purely sporting races, and the following Racing Committee was appointed to draw up a programme and organise Sporting Races for the current year :—

Group-Capt. C. R. Samson, C.M.G., D.S.O., R.A.F.
Mr. G. B. Cockburn.
Air-Commodore E. M. Maitland, C.M.G., D.S.O., R.A.F.

Technical and Competitions Committee.—The report of the Meeting of the Technical and Competitions Committee, held on January 28, 1920, was received.

International Competitions.—With regard to international competitions, it was decided that the Club should make the following entries on behalf of Great Britain :—

3 Entries for the Gordon Bennett Aviation Cup.
3 Entries for the Jacques Schneider Cup.
1 Entry for the Gordon Bennett Aeronautic Cup.

Racing Colours.—It was also decided to open a register of racing colours.

Civilian Flying Schools.—The regulations for approved Civilian Flying Schools were considered and adopted.

Annual General Meeting.—It was decided to hold the Annual General Meeting at the Club on Tuesday, March 30, 1920, at 6 p.m.

MONACO MEETING

The closing date for receiving entries for the Hydroaeroplane Competitions at Monaco, April 18 to May 2, 1920, is February 29, 1920.

GORDON BENNETT AVIATION CUP

SPECIAL REGULATIONS FOR 1920.

(*Translated from the French.*)

1. The contest will be over a Cross-country Course of 300 kiloms. in a closed circuit of 100 kiloms, starting and arriving on an aerodrome.

Alightings, repairs and replenishments are allowed throughout the contest.

2. Aero Clubs must produce for each of the machines entered the following declaration :—

(1) A written declaration from the constructor that the strength of the Wing Structure has been calculated for a load factor of 6 for monoplanes, and for a load factor of 4 for multiplanes, with the weight of petrol and oil corresponding to the distance of 300 kiloms.

For machines with variable surface these load factors must be complied with, whatever the extent of the wing surface.

(2) Any declaration found to be inaccurate will entail disqualification of the competitor and forfeiture of the entry fee.

The declarations of the constructors and Aero Clubs must reach the Aero-Club de France, the organisers of the Contest, seven clear days before the contest.

3. The machines must be on the aerodrome not later than 7 a.m. on the day preceding the date fixed for the contest.

The officials will inspect the machines and make all verifications which they think necessary.

The machines must not be altered after verification. The principal parts will be stamped or sealed.

4. The Aero-Club de France will award to the winner a prize of 10,000 francs.

The contest will take place in France towards the end of September or at the beginning of October, 1920.

THE FLYING SERVICES FUND

(*Registered under the War Charities Act,* 1916)

Administered by the Royal Aero Club

For the benefit of *Officers, Non-Commissioned Officers and Men* of the ROYAL AIR FORCE who are incapacitated while on duty, and for the widows and dependants of those who are killed or die from injuries or illness contracted while on duty.

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Secretary :
H. E. PERRIN.

Bankers :
Messrs. BARCLAYS BANK, LTD., 4, Pall Mall East, London, S.W. 1.

Subscriptions :	£	s.	d.
Total subscriptions received to February 10, 1920	16,971	8	7
Mrs. I. Taylor	2	2	0
Donation from the Aeroplane Experimental Station, Martlesham Heath	15	7	0
Total, February 14, 1920	16,988	17	7

Offices: THE ROYAL AERO CLUB,
3, CLIFFORD STREET, LONDON, W. 1.
H. E. PERRIN, Secretary.

Balloon Regulations

THE Air Ministry announces that the following Notice to Airmen (No. 14) has been issued :—

"The Secretary of State for Air has issued an Order amending Regulation 2 of the Air Navigation Regulations, 1919, by adding a new Clause 4 ; which is as follows :—

"(4) A fixed balloon shall not be flown within five miles of any aerodrome except with the special permission, in writing, of the Secretary of State, and subject to any conditions that may be attached to any such permission, and the Secretary of State may, on the granting of such permission or subsequently, direct that the provisions of these Regulations or any of them shall not apply to the balloon in question or shall apply subject to such modifications as he thinks fit."

THE PRINCIPLES OF RIGID AIRSHIP CONSTRUCTION

BY A. P. COLE, R.C.N.C., A.M.Inst.N.A.

(*Concluded from page* 186.)

Gasbags

THE gasbags in a rigid airship are protected from the effects of the weather and direct sunlight by the outer cover, so that no special precautions are required in this connection. Care has to be taken that the gasbags are effectively supported by wires, nets, girders, etc., and that all sharp edges or corners likely to injure the bag are covered (*cf.* Fig. 3).

The material generally used is a skin-lined fabric. The skin is goldbeater's skin, which is the outer coat of the cæcum or blind gut of the ox. Other skins, such as beef casing, which is one of the coatings round the intestines of a cow, have also been successfully used. A good goldbeater's skin is practically impermeable to hydrogen. The fabric used is usually a high quality cotton, the strength and weight being

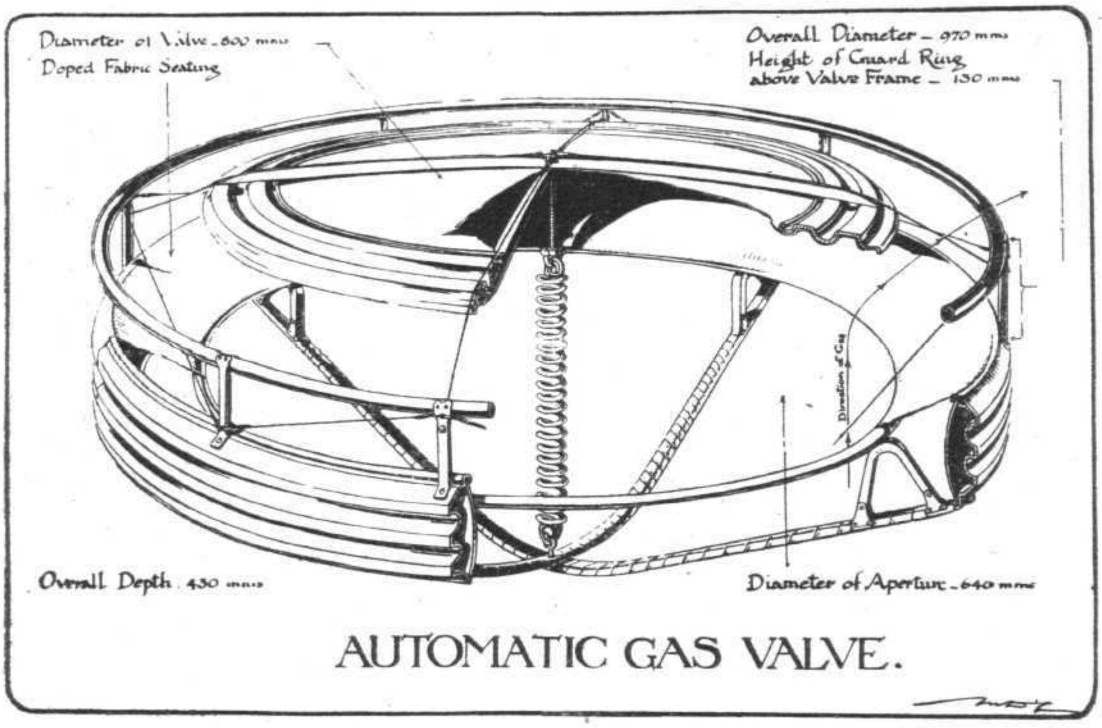


Fig. 8.—Automatic valve as fitted in R 34 class

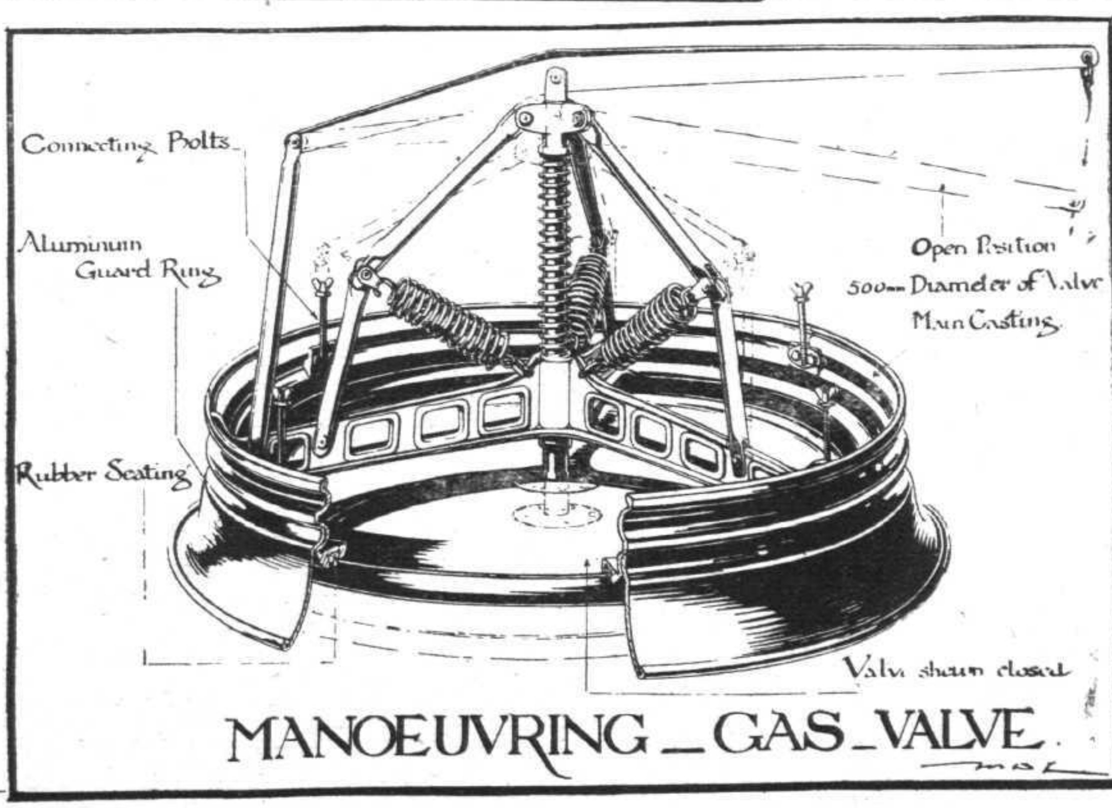


Fig. 9.—Manœuvring valve

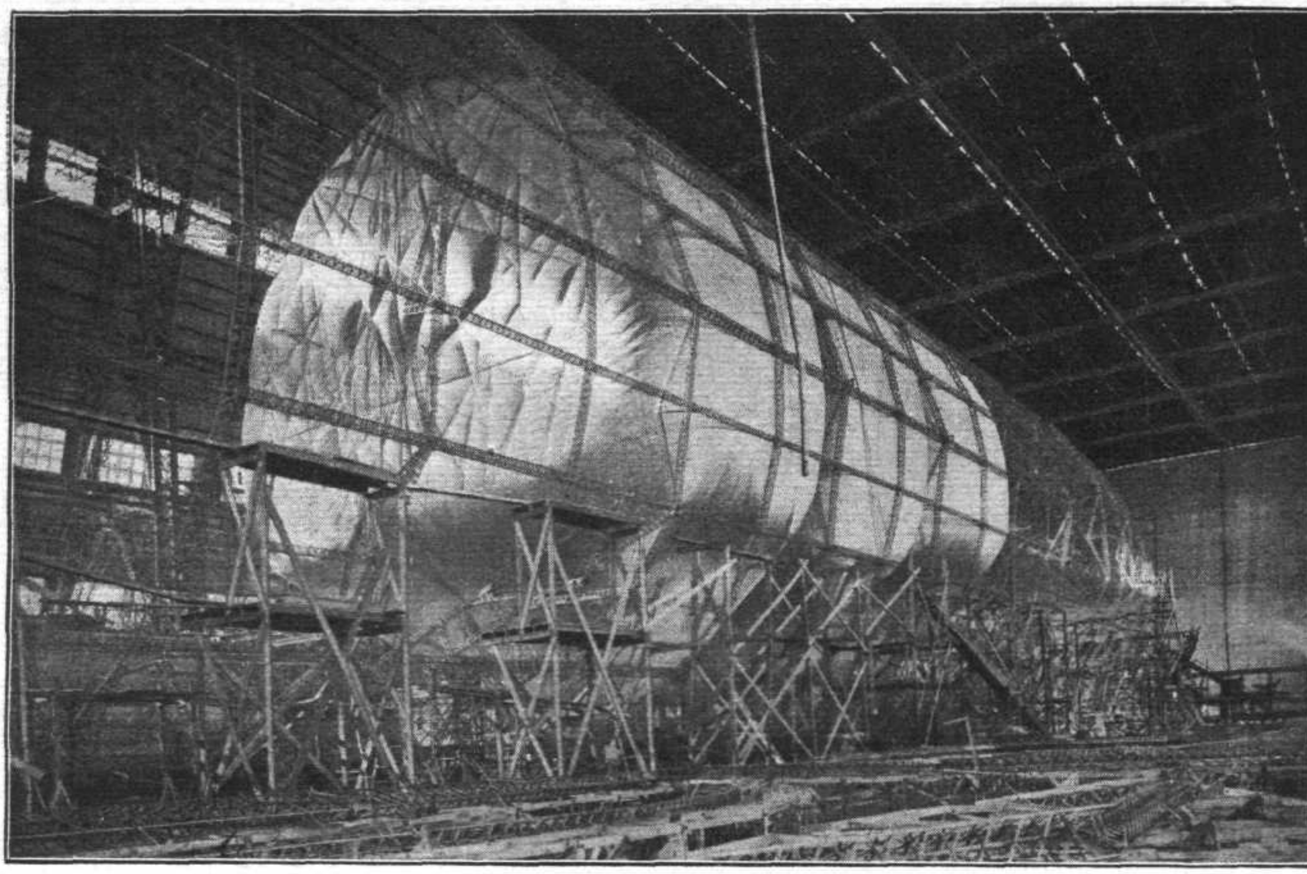


Fig. 10.—Gas-bags in place in R 34, showing " flat " formed at bottom of bag when partially deflated

dependent upon the size of the bag and maximum pressure. The standard cotton fabrics in this country are as shown in Table IV.

TABLE IV

Quality.	Weight. grms./sq. metre.	Strength. kilograms/metre width.
A	130	1250
B	110	1100
Bx	90	900
C	80	800
Ck	80	900
D	65	650
E	45	510

An interesting fabric which was used by the Germans in L 70 was jap silk, having a weight of 30-35 grams/sq. metre and a strength of 435 kilograms per metre.

The fabric used in R 33 class airships was Bx cotton weighing 90 grams per sq. metre.

The maximum tension in the fabric is assumed to be given by the relationship

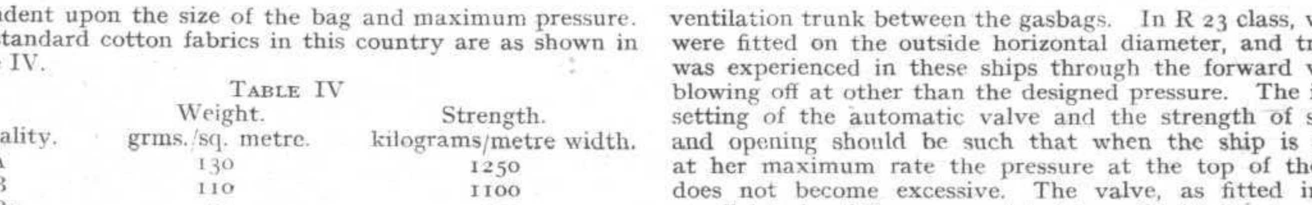
$$T = pR \text{ kg./metre}$$

where p = pressure of gas in kilograms per sq. metre.
R = radius of bag in metres.

Each gasbag in the ship must be provided with an automatic valve to enable the gas to escape when the ship is rising and so prevent excess pressure in the bag (Fig. 8). The position of this valve must be such that it is unaffected by changes in the air pressure on the outer cover and is also easily accessible. This is attained in recent ships by fitting the valve on the flat end of the bag just above the corridor, and carrying off the gas to the top of the ship by means of a ventilation trunk between the gasbags. In R 23 class, valves were fitted on the outside horizontal diameter, and trouble was experienced in these ships through the forward valves blowing off at other than the designed pressure. The initial setting of the automatic valve and the strength of spring and opening should be such that when the ship is rising at her maximum rate the pressure at the top of the bag does not become excessive. The valve, as fitted in the parallel body of R 33, was set to blow off initially at 14 mm. of water, the tension of the spring and opening being such that when the ship was rising vertically, at say 2,300 ft. per minute, the maximum blowing off pressure was approximately 25 mm. of water, corresponding to a pressure at the top of the bag of approximately 46 kg./sq. metre.

In addition to the automatic valve a manœuvring or hand-operated valve (Fig. 9) is usually fitted at the top of some of the bags, chiefly for the purpose of enabling the pilot to valve gas in landing should the ship become too light. As a general rule these manœuvring valves should not be fitted to the after bags, as it is desirable with the very fine tails now used always to retain as much lift as possible aft.

When the ship rises into air of less density and pressure than as stated above, the gas in the bags expands and blows off through the automatic valves. If the ship subsequently descends, although the total weight of gas contained within the bags is unaltered, the volume which it occupies is necessarily decreased. The bag consequently is only partly full and the bottom of the bag rises. The shape of the bag in this condition is remarkable, as the bottom forms an absolute " flat " and gives a very good indication of the degree of fulness of the bag (Fig. 10). Care must be taken



GENERAL ARRANGEMENT OF GLAND FITTINGS FOR SHEAR WIRES AT UPPER END

Fig. 11.—Showing method of fitting gas-bag sleeve on cone

that all fittings on the bag which are, in addition, attached to the structure of the ship, are arranged to allow for this movement without causing excessive tension in the fabric. This is in general accomplished by fitting cones or sleeves of fabric between the gasbag and the fitting (Fig. 11).

Outer Cover

The outer cover consists of a number of panels of doped fabric stretched over the outside of the ship for the purpose of providing a fair surface and to protect the girderwork and gasbags from weathering and exposure (Fig. 12).

The fabric may be either cotton or linen, the dope is usually a cellulose acetate dope. The total weight of doped fabric should not exceed about 120 grams per sq. metre. The requirements for the dope in rigid airships are essentially different for those for aeroplanes. It is of the utmost importance that the weight of the dope applied should be as small as possible, but at the same time waterproofness must be assured. Tautening is not of material importance. If the dope is applied to the fabric before tha latter is made up into the ship, it must be sufficiently flexible not to crack when the fabric is folded. The most satisfactory procedure is to apply the preliminary coats of dope by machine before the fabric is made up, and the final coat when the fabric is in place on the ship.

The colour of the dope depends upon the service to which the ship is being put. For tropical work zinc white or aluminium powder is preferred, owing to the necessity of avoiding superheating of the gas as much as possible, and also to protect the fabric against tendering. During the War the Germans coated the under portion of their ships with a black dye dope, and the upper surface a mottled colour. This, of course, was for night work.

When excessive pressure is likely to occur on the outer cover, as for instance forward owing to the air pressure on the bow, or in the wake of the propellers, wire or girder stiffening should be provided for support. Formerly heavier covers were fitted in these positions, but this has been found not to be necessary.

Factors of Safety

The factors of safety to be given to the various items of an airship naturally depend on the degree of reliability which may be placed upon the assumptions, the probability that the stress in the part concerned may become greater than that calculated, and the nature of the forces which come upon the part. For items subjected to vibratory or shock loads, such as car-suspension wires, a high factor of safety is necessary. The worst case that can generally occur is when the ship is either climbing or diving at its maximum rate, and a factor of safety of at least four to six should be obtained in the car suspensoins under either of these conditions. On the other hand, on items which cannot have a load in them beyond a certain maximum or when the assumptions made are the most extreme, such as for instance, the gasbags, and longitudinals in the first case, or the transverse frames in the second case, a large factor of safety beyond the calculated load is not necessary or indeed desirable, as the weight of the part is increased thereby.

It is difficult, however, to generalise on what the factor of safety should be, and the choice of any particular figure usually depends on the individual designer and previous experience.

Handling and Mooring Arrangements

When the ship is in the shed and partially deflated, it is desirable to support her as much as possible in order to prevent deformation of hull. This is done by fitting strops to the joints of the top longitudinals and main transverse frames, and slinging the ship from these to the top of the shed. Lugs are also provided at the inboard elevator pintles for the same purpose. The cars are supported in cradles from the ground.

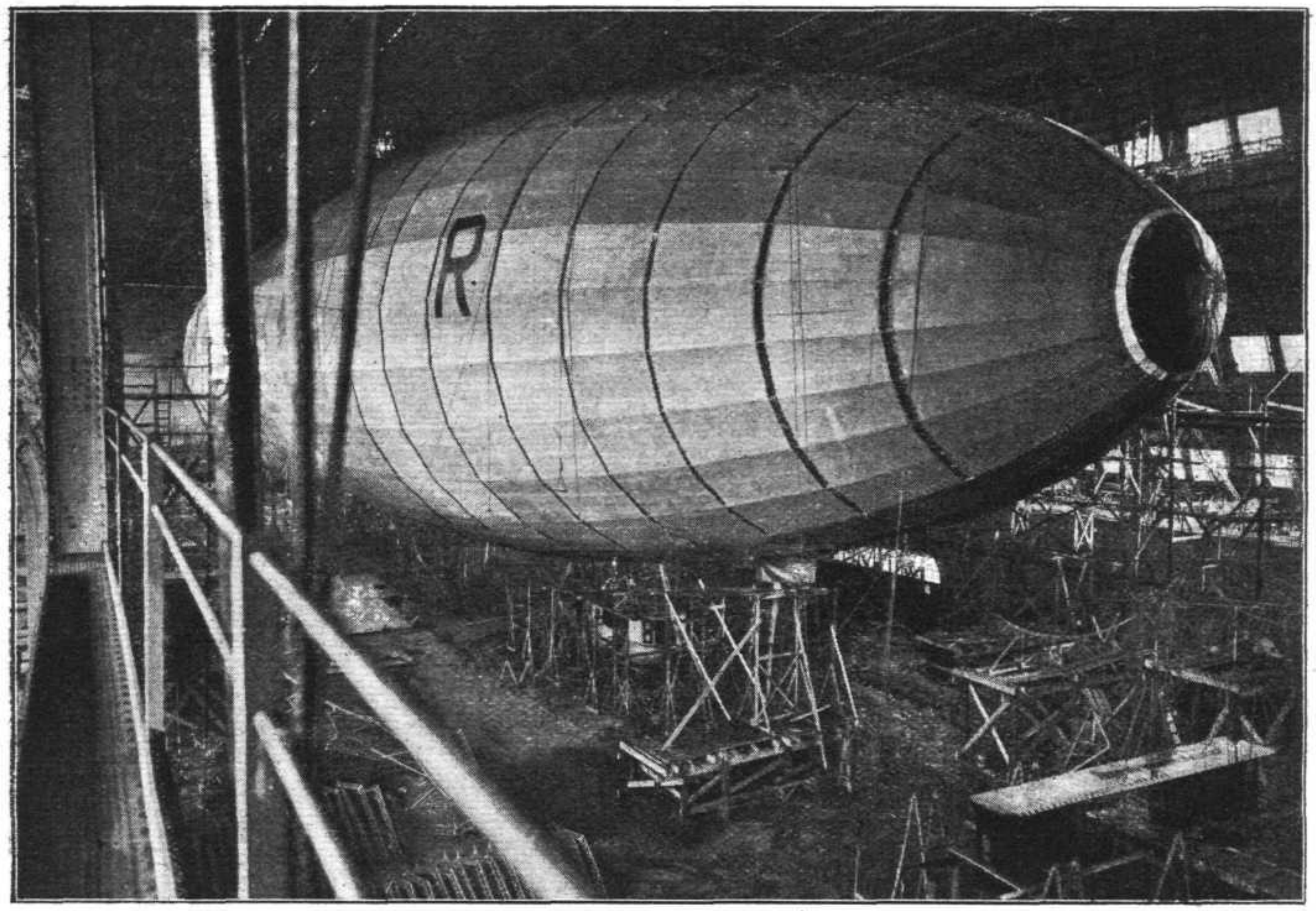


Fig. 12.—R 34, showing outer cover being laced into place before sealing strips are put on

For handling the ship on the ground, arrangements must be made for a trail rope forward and aft which can be dropped when the ship is within 500 ft. of the ground. These trail ropes, which should be as far forward and as far aft as possible consistent with the strength of the ship, must be capable of being released from the control car. In addition, at frequent intervals along the ship, handling wires should be fitted about 25 ft. long with a bight on the end, to which toggles ropes can be attached. These arrangements should allow for the greatest restraining moment to be put on the ship with the least force.

If the ship is to be moored to a mast, special stiffening in addition is necessary in the bow. As the greater pull comes on the ship at the forward trail rope, special care is necessary to distribute this load as equally as possible from this point, throughout the structure. This is accomplished in Zeppelin ships by attaching the mooring point to a wire system whereby

the strain is distributed vertically over a transverse frame, and horizontally along the corridor and framework of the ship.

Distribution of Fixed and Non-Dischargeable Weights

The fixed weights of the ship are mostly determined by structural considerations, and their position cannot be altered. In the design stage, however, a certain amount of latitude is allowable in fixing the position of the cars. These should be so arranged that the propellers do not mask each other, and also that when the ship is at rest at her maximum static height, with all gasbags full, and with the non-dischargeable weights in their appointed positions, there is a moment by the stern. This is always preferable to a moment by the bow.

At least two wing cars, one on either side, should be fitted as far up the side as possible, so as to enable manœuvring to be carried out near the ground if necessary without any danger of the propellers hitting the ground.

The landing ballast should be distributed so as to allow the pilot to change trim quickly if necessary when landing. For this purpose, it should be divided as far as possible aft and forward consistent with strength. Average figures are:

Forward landing ballast 1·5 to 1·75 per cent. of total lift.
Aft landing ballast 1·5 to 1·75 per cent. of total lift.
Midships landing ballast 1 per cent. of total lift.
Total, 3·5 to 4·5 per cent. of total lift.

The landing fuel is, of necessity, stored as near as possible to the various power units in the fixed petrol tanks.

Distribution of Dischargeable Weights

The dischargeable weights can be divided for the purpose of distribution under three headings :—

Ballast,
Petrol and oil,
Stores.

The petrol and oil should be distributed in relation to the position of the engines, and should be such that at any trim that the ship may take up, there is always an adequate supply to the engines. In recent ships the petrol has been carried in aluminium tanks suspended from the corridor, each tank carrying 200 or 300 kg. petrol. The tanks are so arranged that they can be slipped and discharged overboard in case of emergency. Certain tanks are, however, made fixed for use as service tanks.

The water ballast is carried in fabric bags, each carrying approximately 1,000 kg. (one ton) of water, suspended in the corridor. The ballast is discharged outside the ship through a valve at the bottom of the bag and a fabric hose or aluminium pipe, time of emptying bag being 65 secs.

In general, an excess number of positions for ballast bags and slip petrol tanks are provided beyond the number actually required in the "standard" conditions, to allow for variations in initial lift due to atmospheric and purity conditions and to allow the pilot as wide a range as possible for trimming the ship.

Horse-Power and Speed

The resistance to motion of an airship is made up of :—

1. Resistance of the ship's form.
2. Resistance of the fins, rudders and elevators.
3. Resistance of the cars and propellers, if any of the latter are fixed.
4. The resistance of the external wires, such as fin inter-bracing wires, gondola suspension wires, struts, etc.
5. Miscellaneous resistances, such as radiators, ladders, etc.
6. Augmented resistances due to wake of propellers.

Model results are usually given for (1) only. They are expressed in terms of the resistance coefficient

$$C = R/\rho v^2 V^{\frac{2}{3}} \text{ and } vV^{\frac{1}{3}}$$

where R = resistance of ship's form.
v = speed.
V = volume of air displaced by ship's outer form.

From theoretical considerations, using the principle of dynamical similarity, C should be the same for similar ships for the same value of $vV^{\frac{1}{3}}$. The maximum practical value of $vV^{\frac{1}{3}}$ in the wind channel for, say, a 1/120th size model, which is obtained for an air speed in the channel of 80 ft./sec., is only 1/88th of that for the full-sized ship at 40 m.p.h. The law of variation of C for values of $vV^{\frac{1}{3}}$ between these two limits is not known. Hence the prediction of the resistance results from model experiments cannot yet be done with any degree of accuracy. From trials on ships running at a constant height, it has been established that by running various combinations of engines at full power, then

$$\text{Total B.H.P.} \propto (\text{speed})^3.$$

If speed is measured in miles per hour, then for a ship similar in form to R 33, and with the same efficiency of propellers and gearing, approximately,

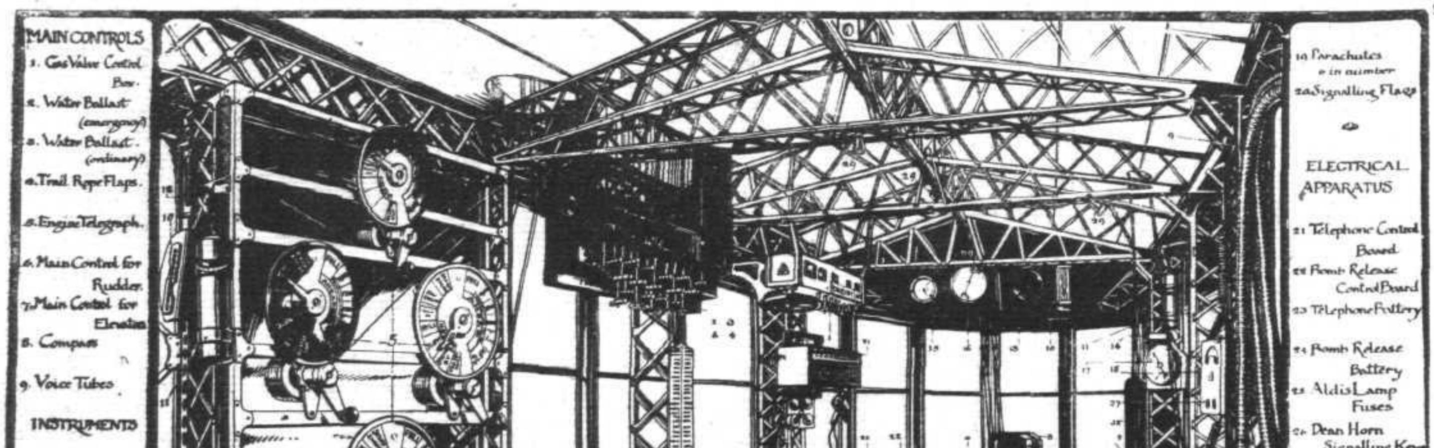
$$\text{B.H.P.} = 0{\cdot}0058 \times (\text{speed in m.p.h.})^3.$$

To obtain the b.h.p. required for a similar ship of different displacement it is sufficiently accurate to a first approximation to take the b.h.p. to vary as $(\text{total lift})^{\frac{2}{3}}$.

The weight of machinery and engine car may be assumed to vary directly with the horse-power, though care must be exercised in using this rule owing to improvements in design. An average figure given by Mr. Campbell before the Institute of Naval Architects was 10 lbs. per b.h.p.

Proportion of Fixed Weight to Total Lift

The efficiency of a design is measured by the relative values of the fixed weights to the total lift—the lower this



General arrangement of control car, R 33, showing position of water ballast and manœuvring valve controls, steering and elevating hand-wheels, etc.

ratio the more efficient the design. As previously explained, the fixed weight is made up of hull, fabric and miscellaneous weights and machinery and car weights. The last set depends upon the speed, and to a first approximation for present designs of engines, may be taken as

W in lbs. $= \cdot 0038 \times$ (max. speed in m.p.h.)$^3 \times$ (total lift on tons)$^{\frac{2}{3}}$.

The ratio of the hull, fabric and miscellaneous weights to the total lift measures the efficiency of the design from the ship designer's point of view.

No law can rationally be given as to the variations of the remaining fixed weights to total lift, as the design of the various parts is so far not advanced sufficiently to enable any deduction as to the variation of weight with dimensions to be made. As illustrative of this, it is interesting to note that with practically the same total lift, the weight of hull, fabric and miscellaneous items was reduced from 28·9 tons in L 33 to 19 tons in L 65.

Subsequent Developments

This paper has dealt almost entirely with the principles of airship construction with special reference to the Zeppelin types. Of all types which have been examined this appears to be the most practical and promising form, the development of which has been marked by the greatest progress. It also lends itself most readily to adaptation to larger sizes principally on account of the relatively economical disposition of material from an engineering standpoint. As mentioned previously in the paper, the actual design of girders, however, will most probably be materially and radically modified, chiefly by the introduction of steel in construction, and possibly some saving in weight by the use of welding instead of riveting. With present sizes of ships the thickness of steel sections, however, would be so small as to be impracticable.

Another item which will profoundly influence the type of construction is cost. Steel construction will be much cheaper than duralumin, both in material and labour.

Developments in gasbags may be expected in the direction of finding a substitute for the expensive goldbeater's skin. Various substitutes have been tried, but so far have not proved successful, for although a compound may look promising on a test piece, yet when worked into a bag and crumpled, it usually has a high permeability. The relative merits of gastightness or lightness have not yet been satisfactorily settled; if gas is expensive, as for instance helium, then gastightness is of prime importance. Helium, however, has a permeability of only about 0·65 that of hydrogen, so that the loss of helium through the bag will probably be less than the present rate of hydrogen. The Germans, however, appeared to have attached more importance to light weight, relying on the frequent purging of the gas through refilling after flight to maintain the requisite purity.

It is probable that the outer cover will remain doped fabric. Aluminium plate, even in the thinnest sections, would be too heavy, and would require to be very carefully supported.

Conclusion

I am indebted to Sir Eustace d'Eyncourt, K.C.B., the Director of Naval Construction, for permission to read this paper, and to the Air Ministry for permission to publish the information contained therein.

MORE N.P.L. REPORTS AVAILABLE—(LIST No. 3)*

REPORTS AND MEMORANDA :—

Tests on Two Models of Caquot Kite Balloons. (247, November, 1916. 3*d.*)

Experiments on Models of Aeroplane Wings. (248, May, 1916. 1*s.*)

Tests on the Complete Model of F.E. 5 Aeroplane. (249, June, 1916. 1*s.* 3*d.*)

Tests on Aeroplane Bodies. (251, August, 1916. 4*d.*)

Model Test on Fairing and Chassis Axle. (255, May, 1916. 3*d.*)

Instruments. (295, May, 1916. 1s. 6d.)

Preliminary Reports on Measurements of Accelerations on Aeroplanes in Flight. (New Series.) (376, September, 1917. 2*d.*)

On a Method of Estimating from Observations on the Slipstream of an Airscrew, the Performance of the Elements of the Blades, and the Total Thrust of the Screw. (460, June, 1918. 4*d.*)

Notes on the Prediction and Analysis of Aeroplane Performance. (474, May, 1918. 1*s.*)

Full Scale Stability Experiments with R.A.F. 14 Wing Section. (505, June, 1917. 3*d.*)

Influence of Time on the Breaking Load and Elasticity of Spruce Members of Aeroplanes. (510, February, 1918. 9*d.*)

Preliminary Report on the Permeability Variation of the Hydrogen of Rubber Membranes with Alteration in Temperature. (513, August, 1917. 2*d.*)

Report on Protective Varnishes for use on Aeroplanes in Hot Climates. Part 2. Experiments in Sunlight. (514, August, 1917. 4*d.*)

On the Dissipation of Heat from the Surface of an Air-cooled Engine when Running and when at Rest. (520, October, 1917. 6*d.*)

Flying as Affected by the Wind. (521, November, 1917. 6*d.*)

Experiments on Models of a "Duplex" Wind Channel. (522, November, 1917. 1*s.* 6*d.*)

On the Steady Flight of an Aeroplane, when the Gradual Loss of Weight owing to the Consumption of Petrol is taken into Account; with special reference to the Minimum Consumption of Petrol. (527, January, 1918. 6*d.*)

A Preliminary Investigation of Certain Elastic Properties of Wood. (528, February, 1919. 1*s.*)

Full Scale Experiments with different shapes of Tail Plane. (532, March, 1918. 3*d.*)

High Altitude Flying. (534, March, 1918. 1*d.*)

Effect of Compressibility on Streamline Motions. (555, December, 1918. 6*d.*)

Description of an Apparatus for Measurement in a Wind Tunnel of the Performance of an Airscrew or the Windage Torque of a Rotary Engine. (563, July, 1918. 3*d.*)

Critical Loading of Struts and Structures, Part 6. Effect on Variation and Strength of a Strut or Spar due to Variation along the Bay of Longitudinal Thrust, Flexural Rigidity, and Mass per Unit Length. (566, November, 1918. 2*d.*)

Tests Swivelling Pressure Heads. (567, October, 1918. 4*d.*)

Report on Tests of a Model of the Proposed No. 2 7-ft. Wind Channel at the R.A.E. (574, December, 1918. 1*s.*)

Some Experiments with Models of an Airscrew, a Rotary B.R. 2 Engine, Two different Types of Engine Cowling, and a Body of the Snipe Aeroplane. (591, February, 1919. 6*d.*)

Accidents to certain Aeroplanes with special reference to "Spinning." (Communicated by the Accidents Investigation Committee.) (592, December, 1918. 6*d.*)

Summary of Present State of Knowledge with Regard to Airscrews. (594, February, 1919. 6*d.*)

Rotation of an Aerofoil about a Fixed Axis. (595, March, 1918. 4*d.*)

Experiments on a Twisted Aerofoil. (601, April, 1919. 4*d.*)

Gliding Tests of a Modified S.E. 5 Aeroplane. (603, April, 1919. 6*d.*)

Some Further Experiments on Tandem Airscrews. (605, November, 1918. 9*d.*)

Reduction of Aeroplane Trials for the Purposes of Aerodynamic Comparison and Prediction. (608, September, 1918. 9*d.*)

The Decay of Eddies. (609, April, 1919. 4*d.*)

Errors of the Readings of Altimeters and Airspeed Indicators due to Variations of Temperature of the Air. (610, May, 1919. 2*d.*)

The Effect of Accelerations on the Resistance of a Body. (612, May, 1918. 6*d.*)

Measurement of the Effect of Accelerations on the Longitudinal and Lateral Motion of an Airship Model. (613, June, 1918. 3*d.*)

The Inertia-Coefficients of an Ellipsoid moving in Fluid. (623, October, 1918. 2*d.*)

Vibration Speeds of Airscrew Blades. (626, May, 1916. 3*d.*)

INTERNAL COMBUSTION ENGINE SUB-COMMITTEE REPORTS :—

Effect on the Resistance to Fatigue of Crankshafts of a Variation on the Radius of Curvature of Fillets. (15, October, 1919. 3*d.*)

* Previous lists were published in "FLIGHT" for July 3, 1919, and October 23, 1919.

CORRESPONDENCE

[*The Editor does not hold himself responsible for opinions expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters intended for insertion in these columns.*]

PARACHUTES—POSITIVE AND NON-POSITIVE

[1995] In his letter to you of February 5, my old controversialist kindly draws attention to my work, possibly with the idea of "drawing" me.

Well, I am not an unwilling victim especially if the benefit of a little practical experience can be made use of by the ingenious colonel.

With regard to positive opening, for which term I hear I am responsible, it must not be lost sight of that this has two entirely different aspects.

The first is what I term registration of opening.

I have observed that the length of free fall of positive-opening parachutes is in direct proportion to the load compounded with the air-speed. They can be relied upon with precision to open within a few feet of a calculated distance.

Knowing this I jumped with a positive opening parachute from the Tower Bridge, only 153 ft., and have since jumped three times from aeroplanes at heights estimated by their pilots at less than 250 ft.

If I had not known this do you suppose I should have been such a fool at my age with responsibilities as to have attempted these drops which people who know nothing about registration of action imagine were done out of dare-devilry?

Believe me, sir, what ever we may have been at 20, we are not dare-devils at 40.

The second point is psychological.

Quite apart from a predetermined limited depth of free-fall, the knowledge that the parachute is forcibly opened is most reassuring at the moment of jumping.

With parachutes having problematical opening, like the common kite-balloon type, the uncertainty of the free-fall is such that no one ever dreams of making a practice drop with it at less than 2,000 ft., whereas the majority of the couple of hundred jumps which have been made with the Guardian Angel parachute—the only positive opener with which human drops have been made—have been done from less than 1,000 ft., and at least twenty of them have been done from less than 500 ft.

The kite-balloon Spencer parachute has done wonderful work in the war, only three men in 600 being killed by total failure of the parachute to open. A good many observers have jumped with it from their balloons at less than 1,000 ft. and Lieuts. Bacchus and Mendl from only 350 ft.; but its opening was always uncertain and the depth of free-fall quite independent of the load, etc.

It might be thought that this does not matter, nor does it much, if you have "tons" of height, but if you haven't and you touch the ground before the free-fall has come to an end you will find yourself in one of those perfectly pink palaces with perfectly purple parks that Mr. Vale Owen tells us about in the *Weekly Despatch* every Sunday.

I know all about it. I fell an independently calculated distance of 784 ft. out of 1,200 ft. at Roehampton. The parachute opened exactly three seconds before I became a candidate for the pink palace.

No amount of argument will convince any one who has made a drop that uncertain opening is as good as positive opening or that positive-opening is overrated.

Why, one observer was reported to have fallen 3,500 ft. in a K.B. parachute before it opened, and I have direct personal records of over a dozen observers who had free falls estimated at 500 ft. and over.

The best test of the psychological value of positive-opening is to let a competent medical investigator make comparative tests of the nervous reaction of several parachutists before making drops with a positive opening and a problematical opening parachute respectively.

It is quite easy to do. I have submitted myself several times to the tests, and got a pat on the back once from Col. Flack, C.B.E., M.D.

I would rather not publish the incriminating record, for you would think me a bigger coward than I really am, but if I tell you that when about to use the best positive-opener I know of my sluggish pulse rises from 56 to 112, and with a problematical opener it rose to 129 (there was also something about apostolic blood-pressure as far as I remember), it will reveal to you what a considerable nerve strain parachuting imposes, even on the initiated.

There now, I'm afraid I've rather let the cat out of the bag. We always pretend we don't turn a hair.

Of quite as much importance as positive opening is tangle-proof rigging. For aeroplane work, where the eddies of the slip-stream whip and flog the rigging, it is positively asking for trouble not to use tangle-proof rigging.

In parachutes like the Mears and Smith Salvus, where the rigging is not exposed until the parachute is well clear of the machine, it is unaffected by eddy currents, but there is still the same liability to tangle as is always present with every parachute under the most normal conditions.

During the War dozens of kite-balloon parachutes came down all or part of the way with varying tangles in the rigging.

In my opinion positive-extension is also a *sine qua non*. By this I mean that there should be a positive reaction against which the rigging and silk can be pulled until the whole is fully extended.

In most parachutes, including the kite-balloon type, this is very simply effected by the apex remaining attached to the case by a small "breaking-cord" until the last moment. Air gives a sufficiently strong elastic reaction, but it is not positive.

There are, all the same, a good many practical types which work quite satisfactorily on this principle, amongst them the following: Robert, Leo Stevens, Broadwick, Floyd-Smith, Irving, Jahns, Smith-Salvus and Skyhook, the first five of which have been tested by human drops.

The extension of the rigging subsequent to the development of the silk throws a big peak of pressure on to the latter, unless the kinetic energy of the falling load is partially absorbed by letting the rigging pay out against a friction device or by the introduction of ample shock absorbers. More cases of bursting have occurred with parachutes of this type than with positive-extension parachutes.

Positive-extension means that the reaction must be taken from the aircraft, though the actual point of reaction may be indefinitely produced by the simple expedient of attaching the parachute-container to a long cord.

"Ha! that's just what you can't do," say the critics; "the kinetic energy developed by a falling parachute-container will snap the cord if you have it more than a few feet long."

Now that's just where they are wrong. They seem to think that with all the positive-extension parachutes the container must be so close up under the *fuselage* at the moment of delivery that the parachute must foul the tail.

Not at all. The kinetic energy of the falling parachute-container can be overcome by a suitable shock absorber, a device which has already been adopted with success. Furthermore, the faster the aerolpane is falling the less the relative speed, and hence the less the impact of the parachute-container when it reaches the limit of the connecting cord.

In order to get the utmost possible speed, the D.H.4 from which I jumped at 250 ft. at Dayton, Ohio, July, 11, 1919, was at the moment in a fairly steep glide. Except for an unusually sudden yank backwards, I noticed no untoward feature.

My companion, Lieut. Caldwell, was killed a few minutes after by an accident in no way attributable to the parachute.

That the positive-extension type of parachute is free from all the dangers immunity from which Col. Holt and Mr. E. E. Smith claim as the special prerogative of their respective inventions, is amply proved by the success of the German pilots who were using parachutes of this type—the Heneicke and the Fokker—during the last four months of the War.

Exact statistics are not available, but in the opinion of Capt. Bishop, when in the 211th Aeroplane Squadron, and who had seen a good many Germans descend from burning or broken machines, quite 90 per cent. got away with it safely.

Whether parachutes will or will not foul the aeroplane in accidents depends entirely on the nature of the accident. If there are no projections on the machine, it does not matter if it does touch.

A falling machine generally has periods of rectitude during which the pilot should seize his lifeline and his opportunity. A burning machine can be controlled until the moment of jumping.

The idea that a spinning machine will roll the parachute up is merely evidence that the critic who advances this nonsense in a serious argument has never been in a spinning machine.

It takes 8 secs. for an average-sized machine to rotate about its longer axis, and only 2 secs. to get away in a parachute.

What will happen when a machine is falling like a stone I don't know, and am certainly not going to try; but whoever heard of a machine falling like a stone?

I've seen plenty fall. They always dart about, glide and otherwise evolute.

Now then, let any of the positive-opening-no-use experts

come forward and jump from any low height, and I'll undertake (because I've done it already) to go one lower in altitude every time with a positive-opener. No dummies, please.

Unless a parachute can be relied upon to operate at altitudes of less than 250 ft., as I have five times proved the positive-opening type can be, the parachute isn't much use, however free it may be from other alleged faults.

3, Temple Gardens. T. ORDE LEES.

FUTURE FLIGHT DEVELOPMENTS

[1996] In view of the developments of flying likely to take place during the course of the next few years, may I be permitted to mention a few points that may be of interest. The Potez machine, exhibited at the Paris Salon, makes a step towards new engine position, and with its vertical crankshaft motor permits equal cooling aspect for each cylinder-head; this no doubt is a great advantage, but I venture to suggest that a better way would be to retain the horizontal crankshaft position, but have the long axis of the engine parallel with the long axis of the plane and at right angles to the conventional engine position; now that the overhead camshaft is almost universal, the air-screw drive could be taken off this by means of bevel gearing, set at the central part of the camshaft length, and driving the air-screw at right angles to it; this would also admit of the cylinder being tilted forward slightly, allowing the stream of cold air to play on the cylinder-heads as well as the exhaust ports, which would, of course, face forwards.

A system of clutches, used with this engine arrangement for large double-engined machines, would permit one engine to drive both air-screws in the event of failure in the other engine.

In the Paris Show report mention was also made of a system of propulsion without engine or air-screw by using the reaction of high velocity jets of gases derived from explosion on the atmosphere; this system would seem to have the merit of simplicity and lack of wear and tear, and should its efficiency be at all passable, should be a great step forward. I, for one, should be glad to see progress in this direction. Another point I should like to mention is in connection with the recent proposals regarding the development of a seaplane or flying-boat capable of "submerging" also; certain aquatic birds are known to be able to travel *under* water at a *much greater* rate of speed than they can move on the surface; in view of the important changes that no doubt will have to be made in our engines of war for offence and defence, this phenomenon is worthy of close investigation by our experts in marine and aero development.

W. A. WOODWARD,
Late R.A.F.

ROYAL AERONAUTICAL SOCIETY NOTICES

MR. J. L. COPE'S lecture on "Aerial Survey in the Antarctic" will take place at the Central Hall, Westminster, on Wednesday evening, April 7. H.R.H. Prince Albert will take the chair at 8 p.m.

The Secretary attended a meeting of the Executive Committee of the Scottish Branch of the Society in Glasgow on Wednesday, February 11, and found that a satisfactory position is being arrived at, the local membership now numbering about 200. In the evening Col. Outram read, in the absence of Air-Commodore Bagnall Wild, owing to indisposition, a very interesting paper on "Safety in Flight." Sections of the Scottish Branch are being opened in Edinburgh and Dundee. The Chairman is Sir William Beardmore, the offices being situated at Blythswood Square, Glasgow.

Major Percy Bishop, Associate Fellow, read a paper on "Aircraft Design in Relation to Standardisation" on Wednesday evening, February 18, at the Royal Society of Arts. Mr. H. White Smith occupied the chair. The next meeting will take place on Wednesday evening, March 3, when Prof. B. Melvill Jones, Associate Fellow, will read a paper on "Flying over Clouds in Relation to Commercial Aeronautics," Lieut.-Col. Tizard, Fellow, presiding. Both lectures will commence at 8 p.m. at the Royal Society of Arts, 18, John Street, Adelphi, W.C. 2.

Members, and particularly Students, are reminded that the Library at 7, Albemarle Street, is open every day, including Saturdays, from 9.30 to 5 p.m.

Members are reminded that all cheques for subscriptions now due should be made payable to "Aerial Science, Ltd."

W. LOCKWOOD MARSH,
Secretary.

CAMBRIDGE UNIVERSITY AERONAUTICAL SOCIETY

THE second meeting of the Society was held on Wednesday, February 11, in the Botany School, Professor B. Melville Jones being in the chair, when a lecture was given by Mr. R. McKinnon Wood, M.A., A.M.I.C.E., A.F.R.Ae.S., chief of the Aerodynamics Department, Royal Aircraft Establishment, on "Experimental Aerodynamics."

Mr. McKinnon Wood commenced his lecture by explaining the various aerodynamic formulæ and pointing out the methods used to obtain the constants involved. He then outlined the construction of the various wind-channels in use, with special reference to those at the R.A.E., and pointed out that the lift of a plane was chiefly due to its top surface. He also explained how, within limits, the stability of a machine varies as the angle of attack. The lecturer then showed several slides of the whirling arm at the R.A.E., and explained the various tests on air screws in which it is used.

The remainder of the lecture was devoted to a review of the methods and apparatus used in full-scale experiments. Mr. McKinnon Wood said that in this work the two most important values to be obtained were the rate of climb and the speed at various heights. Several diagrams and photos. of the manometer were shown on the screen, and the lecturer explained how the pressure at any point on a plane could be found by means of this instrument. Finally he showed how the pitch, roll and direction of a machine in flight could be registered by means of the sun's rays falling on a film moving at a known speed, and concluded the lecture with a series of slides depicting the various types of machines designed and built at the R.A.E.

Mr. McKinnon Wood said that the University had been well represented at the R.A.E. during the War, over 30 Cambridge men being engaged there in experimental and research work, and of these five, namely Professor Hopkinson, Mr. E. T. Busk, Dr. Keith Lucas, Mr. D. H. Pinsent and Capt. H. A. Renwick, had made the supreme sacrifice in endeavouring to forward the science of aeronautics.

PERSONALS

Death

C.P.O. GILBERT H. WM. BUDDS, late R.N.A.S., Warwick Villa, Minster, Ramsgate, who died February 6, 1920, of pulmonary tuberculosis, contracted on active service, took part in one of the first raids on German territory, Cuxhaven, on Christmas Day, 1914.

Items

The first re-union dinner for officers and men who served at Cattewater during the War will be held at the Midland Grand Hotel, St. Pancras, on February 27, at 6.30 p.m. No evening dress. Any ex-officers or men or those still serving, who have not received notification of the dinner are asked to write at once to the Hon. Sec., Mr. H. F. Bosher, 33, Langdon Road, Junction Road, Highgate, N.

AT Harrow Weald cemetery a cross has been placed over the grave of Capt. W. LEEFE ROBINSON, V.C., with this inscription :—"To the ever-loving memory of William Leefe Robinson, V.C., captain, 5th Battalion, Worcestershire Regiment, attached Royal Flying Corps, born July 14, 1895, in South Coorg, South India. Died December 31, 1918, at Harrow. R.I.P."

Round the stone border it is recorded :—"He was the first airman to attack a Zeppelin at night. After a most daring single-handed fight he brought down L 21 a flaming wreck at Cuffley, on the 3rd of September, 1916. Thus he led the way against the German Zeppelin peril threatening England."

Lieut.-Col. JOHN CYRIL PORTE, C.M.G. (R.A.F.), of Norfolk Terrace, Brighton, formerly Lieut., R.N., afterwards commanding R.N.A.S. at Hendon and at Felixstowe, one of the inventors of flying-boats, and formerly managing director of the British Deperdussin Co., who died on October 22 last, aged 35, son of the Rev. Dr. Porte, of Steeple Morden, Royston, left estate valued for probate at £1,446 gross, with net personalty £1,336.

AIRISMS FROM THE FOUR WINDS

"Now, therefore, His Majesty, by and with the advice of His Privy Council, is pleased to order, and it is hereby ordered, that the said tenth day of January shall be treated as the date of the termination of War between His Majesty and Germany."

Such is the tag of the Order in Council published in the *London Gazette* last week, and so at long last we know officially when the War ended—note well—*with Germany!* Presumably we are still carrying-on with the rest of the "forty thieves." Hey-ho!

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Some warning "Don'ts" issued by the Air Ministry in regard to aircraft:—

WHEN AN AEROPLANE IS ON THE GROUND

DON'T crowd round the machine—the pilot must see what he is doing.

DON'T touch any part of the aeroplane, or you may endanger the pilot's life. Do what he asks you at once.

DON'T smoke or throw lighted matches within 20 yards of the machine: there may be dangerous petrol fumes about.

WHEN AN AEROPLANE IS LANDING OR RISING

DON'T run to where you think it will land. Keep out of the way, near a hedge or other obstacle, and wait until it stops.

DON'T stand in the direct run of an aeroplane which is about to rise.

DON'T let children or animals stray in the route of a landing or rising aeroplane.

IN CASE OF ACCIDENT

Beware of fire.

If occupants are injured, get them out at once as gently as possible. Telephone or send for doctor and ambulance. Do not give spirits.

Telephone or send to nearest aerodrome, giving number of machine and position of accident.

If the machine is burning, try and subdue flames with sand, earth, wet sacking, etc., or fire extinguisher if available.

Leave someone to guard the machine, if possible, and inform police.

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It is a point for congratulation that this notice is to take its place, in the ordinary routine, as an "exhibit" at all police stations and post offices in the United Kingdom.

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Following a new outbreak by the "Mad Mullah," carefully planned British action is being taken. If the powers that be really want to make this Mad Mullah mad, aeroplanes are a sure remedy for so fussy a person. So we're glad to note that tanks plus an R.A.F. detachment with 'planes have already been landed at Berbera on the Gulf of Aden.

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As we go to press it transpires the Mullah *has* been made madder by the very direct tactics advocated—in fact, he and his Dervish followers have been completely smashed and scattered by means of the aeroplane under the command of Capt. Gordon. As the Under-Secretary for the Colonies tersely put it when in Parliament, referring to the annihilating punishment inflicted on these marauding fanatics, "It is important to note that this remarkable achievement has been secured without bringing in large numbers of troops, and without the co-operation of any foreign Power. . . . For the first time, in fact, the aeroplane has been deliberately employed as the primary striking instrument and not merely as an ancilliary weapon, and the result is, I venture to think, as suggestive as it is satisfactory."

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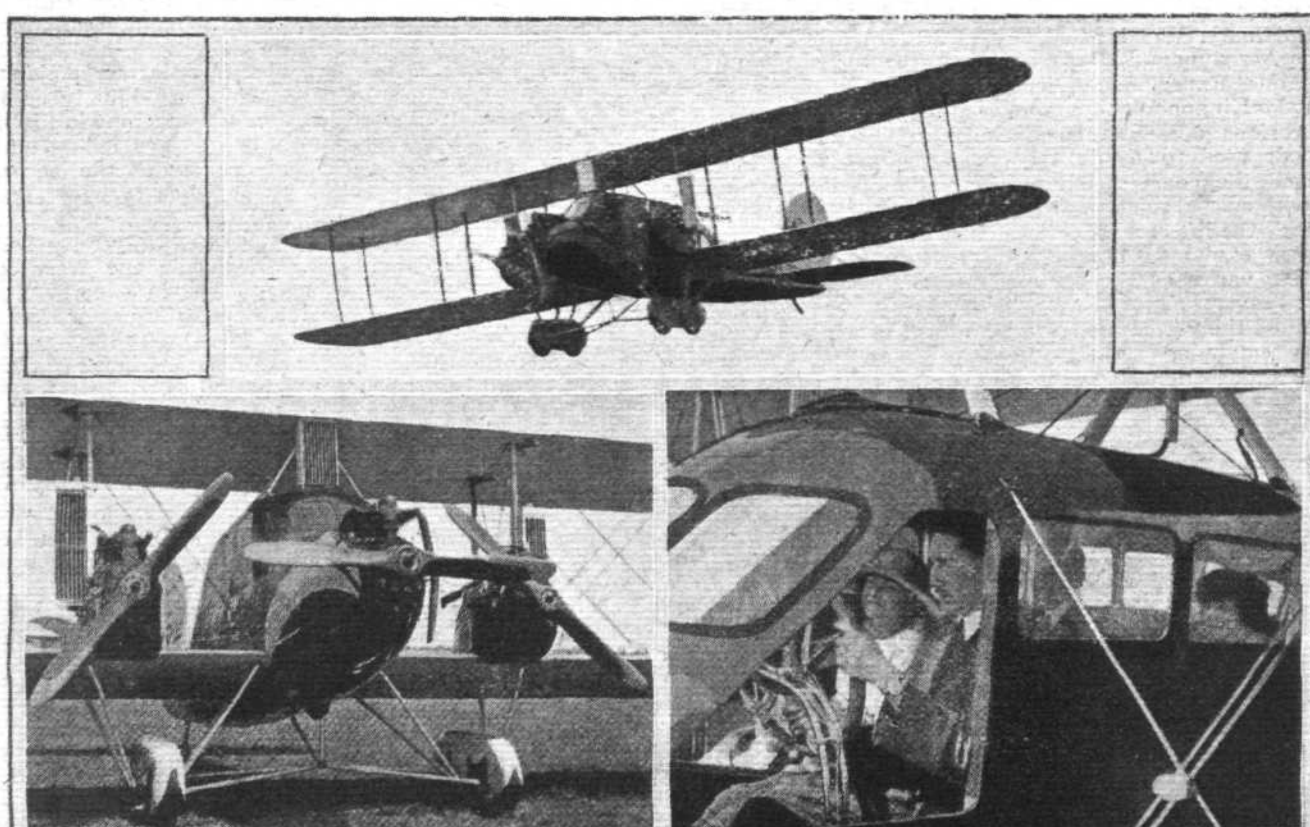
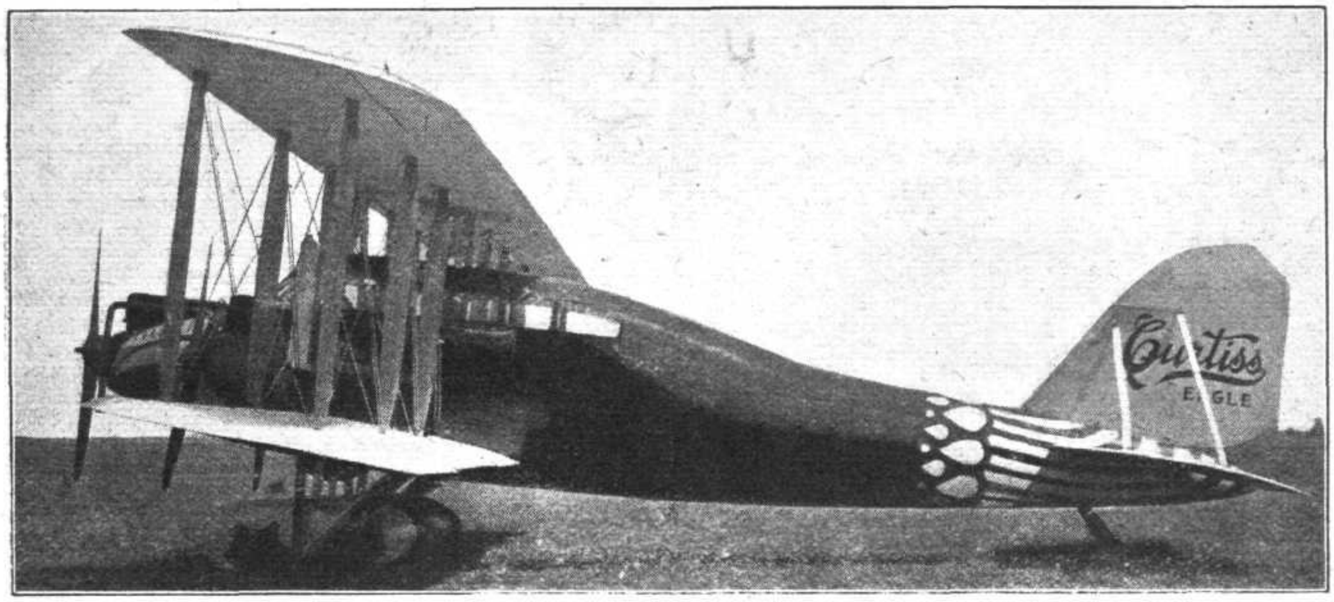
No wonder there were "Cheers" in the House. The moral is obvious, and it is to be hoped may have its effect upon our vacillating Government in their treatment of our aircraft—defensive and offensive.



THE THREE-ENGINED CURTISS "EAGLE" EIGHT-PASSENGER AERIAL LIMOUSINE: Top—The machine in flight. Below—View of the three engines and a close-up view of the pilot's quarters



Side view of the three-engined Curtiss "Eagle" eight-passenger aerial limousine

A CABLED summary of the conclusions set out in the final report of the Aviation Sub-Committee of the House of Representatives, gives a cold douche to the wonderful stories prevalent in 1918 of how American aircraft crowded the air in the War area and brought the enemy to heel. The report states that the War Department spent £210,000,000 for aviation during the 19 months of America's participation in the War, with the result that only 213 American-made planes, all of the D.H. 4 observation type, reached France. The total number of the planes with the Americans at the Armistice was 740, including 527 bought from the Allies, and the report emphasises that no American-built combat, pursuit, or bombing plane reached the front, despite the huge expenditure. The report, containing 50,000 words, charges the Secretary for War, Mr. Baker, and various high officers in charge of the aviation branches with the failure of the United States to be a factor in the air and with wasting many millions of dollars. The fatalities among American flyers were five times greater proportionately than those of any other Power, and this fact is attributed to inferior machines and insufficient training.

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NEW SOUTH WALES apparently does not intend taking a back seat in being up-to-date in aviation. It is announced that Mr. Holman begins an electioneering campaign in the colony by Curtiss aeroplane on February 23, and hopes to be able thereby to address three meetings daily. But why not a British machine?

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PROOF positive, it is stated, has now been obtained by the Inter-Allied Aerial Commission that the seven Zeppelins which should have been surrendered under the Peace Treaty were deliberately destroyed by the Germans in June, most of them at Nordholz, near Hamburg. They were completely dismantled and broken up.

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WHAT is to become of the various aerodromes scattered throughout the country is a problem which should be tackled before they are all dismantled and derelict. For the future success of home flying, this ring of 'dromes is a vital item. That the Air Ministry would gladly see them preserved there can be no manner of doubt, but the accomplishment of this under present economic conditions is no easy task. A move is, however, to be made, so it is authoritatively stated, to enlarge the general powers, by an Act of Parliament, of municipalities, enabling them to undertake the acquisition and running of aerodromes. As this would affect about 140 aerodromes, the importance of this new move may be appreciated. That municipal authorities are already alive to the beneficial results likely to result from having "air-stations" in convenient proximity to their centres, is evidenced by the fact that Sheffield contemplates including powers to deal with the Coal Aston aerodrome in its next Parliamentary Bill. By giving these bodies a general power in this direction, go-a-head councillors would be able to seize the chance of thus enhancing the value of their city without running the risk of being too late, by reason of the protracted legal formalities otherwise necessary to authorise them to move.

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IN spite of the piling-up of handicap on handicap upon the few firms fighting in practical form for commercial aviation, success appears to be attending their heroic efforts. It is good hearing to learn that this spring a reduction in both freight and passenger charges is likely to materialise. This will be but a levelling-up with the action already taken in France, Italy, America and Germany. But in these countries the material support afforded by the Government is vastly different to the neglect of its opportunities by our authorities. It must come though, all the same, and then it will be a case of grab again, we suppose, for official monopoly.

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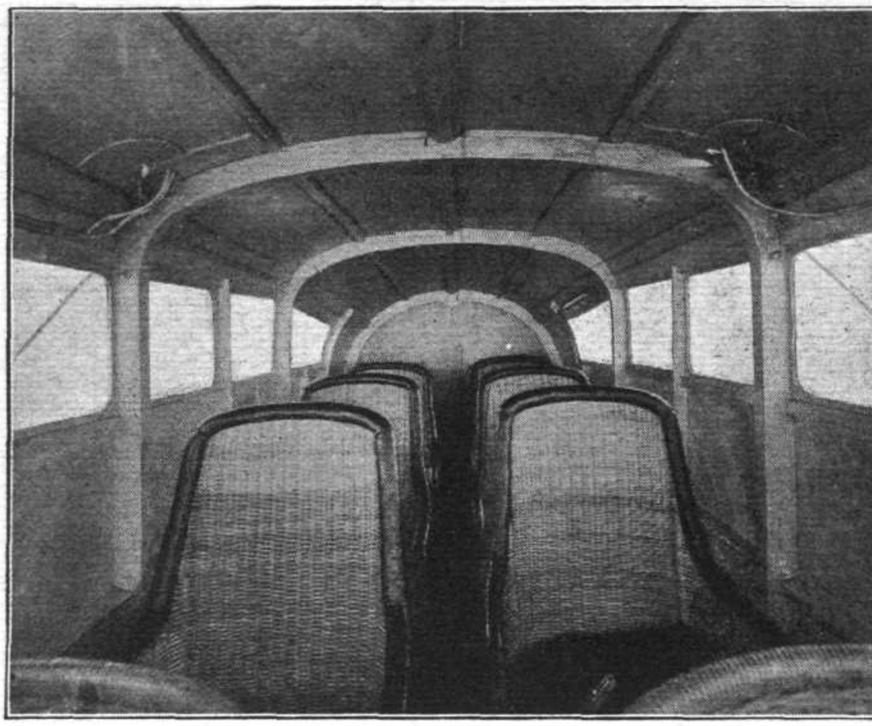
WHEN experts differ, mere groundlings may learn a good deal, provided they sit up and take notice. So it comes about that Mr. J. L. Cope, who is the organiser and leader of the coming South Pole expedition, falls foul of the statements of Sir Ernest Shackleton upon the possibilities of utilising 'planes for exploration work in reaching the Pole.

"On the deck of a whaler," Mr. Cope maintains, "there

Three-quarter rear view of the three-engined Curtiss "Eagle" eight-passenger aerial limousine



Interior view of the cabin of the three-engined Curtiss "Eagle" eight-seater aerial limousine, which was described in a recent issue of "Flight"

s no room to launch a seaplane, and again, where is the seaplane to be kept when it is not in use? Aviation in the Antarctic must be done from the land or the ice. Sir Ernest says there is little known land in the Antarctic from which extended flights can be made. To that I would reply there is the sea ice, and the ramps which are found all round the coast.

"Sir Ernest says that in his opinion it is impossible to fly to the South Pole unless depôts have been laid for 300 miles inland. I, however, can see very little advantage in laying depôts on the ice barrier for 300 miles.

"Again, Sir Ernest Shackleton declares, 'To attempt to fly to the South Pole without a line of depôts, to fall back upon in the event of anything happening to the aeroplane necessitating a forced landing, would be, in my opinion, impracticable and suicidal.' Of course, that is merely Sir Ernest Shackleton's opinion. Under the plans which have been drawn up for the flight, even though a forced landing is necessary after the men have passed 84° South, they will be able to march back as men have done on previous expeditions.

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"ONE impression which Sir Ernest appears to be under," continues Mr. Cope, "is that we are contemplating the flight to the Pole and back in one stage. Nothing could be further from the facts. I do not think that at present such a flight is possible. It is our intention to attempt the flight to the Pole and back in four stages. We shall fly to 84° South, lay a depôt, and then on to the Pole. After taking observations, we shall return to our depôt, and then fly back to the base of the Bay of Whales.

"I am hopeful of maintaining wireless communication with our base for the whole of the journey to 84° South, and it may be possible to maintain communication for a still greater distance. Great stress is laid by Sir Ernest upon the climatic conditions, and he points out that 900 miles of the flight will have to be made at an altitude of 10,000 ft., where the temperature dips to 40° below zero. Weather conditions are, needless to say, a most important factor, but to suggest that 40° below zero is normal in the height of summer is certainly far from the case.

"To fly to the South Pole is a dangerous adventure, but danger has never deterred Britons from undertaking a task. The machine in which we shall make the attempt is specially fitted with ski to allow of its taking-off or landing on the ice, and on snow deeply furrowed. All the experts agree upon the practicability of the scheme which we have prepared, and they are assisting me to make the attempt. Among those who are helping me, I might mention the Air Ministry, the Royal Aeronautical Society, Gen. Sir Hugh Trenchard, and Brig.-Gen. Livingstone."

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FORTY-THREE millions of yards of aeroplane linen, it is true, is no bagatelle, but this week Mr. L. J. Martin, who purchased this little roll from the Government about six months or so ago, announces that he has re-sold the last yard (we wonder if it was a lonely yard, by way of a memento, all on its own). Thus is completed in half a year a deal which Government and the experts claimed would occupy many years to close down. But that's the difference between officialism and a business man. Judging by some of the methods of the Disposal Boards officials we can well believe in officials' hands it might easily have run into the next century, with the "jobs" of the present *régime*, passed on as legacies to their sons, cousins and aunts. So although Mr. Martin may have made a good round sum for himself he must certainly have saved taxpayers many hundreds of thousands of pounds in salaries, pensions, and what not.

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QUITE a fascinating little story comes from America of robbery and an attempt, with the help of an aeroplane, of *proving* an alibi. According to the scribe, it appears that a bank at Benson, Minnesota, was the scene of a daring hold-up and robbery of £25,000. The thieves got away, and no trace could be found of them. When two brothers were charged at St. Paul with the theft, they advanced an almost "ironclad" alibi by proving that they were in St. Paul, a hundred miles from Benson, on the afternoon of the bank raid. The attorney, however, said he had evidence that the men possessed an aeroplane.

You would have thought that would have finished the case. But not a bit like it. A remand was ordered so that the machine might be found, so *finis* to the little drama has still to be written.

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TRULY this episode opens out wonderful visions of the burglar of the future. This side we've got fairly used to the Rolls-Royce daring criminal who conducts his operations upon the grand scale. That their enterprise should soar to such heights as the 'plane brings within their reach had certainly not occurred to us before as a commercial development of the realm of the air. At least it suggests that aviation must be forging ahead pretty strongly in the States if the coming and going of aircraft are as little noticeable as is suggested by the tactics of these progressive thieves.

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THAT man in the moon rocket so airily launched the other day seems to have fizzled out pretty badly. But one bold "airman" has grabbed the opening for self-advertisement and offered to form the "cargo" inside the rocket *when* it is dispatched on its mission. Unfortunately the conditions attached to this offer rather discount the boldness of this hardy sport.

"I hereby volunteer to attempt this interplanetary leap," says Capt. Claude Collins, who from New York is described as "a member of the New York City Air Police and President of the Pennsylvania Aviators' Club," "and offer to do so gratis in an attempt to realise these great aims of science."

Capt. Collins then hedges with no uncertain hedge.

Apart from insisting that he be allowed to assist in planning the rocket, he imposes the condition that "communication either by radio, light, or other means shall have been established with Mars, and a rocket similar to that in which I am to make the leap shall have been constructed, launched, and landed on that planet before my start. Also a board of ten prominent scientists shall agree on the practicability of the rocket as finally designed and on the possibility of it successfully reaching the planet with me inside."

Then apart from such minor details as the obligation of the organisers to ensure his life, the intrepid "airman" lets the cat out of the bag as to his real objective by requiring payment of his expenses of a lecture tour by aeroplane which he proposes to undertake through the great American cities before "taking off" in his attempt to rise to fame.

Evidently **an air man, and a hot-air one at that.**

THE FLIGHT TO THE CAPE

IN our last issue we were able to briefly record the arrival of *The Times* aeroplane at Khartoum and the completion by the "Silver Queen" of the first stage from London to Heliopolis. Below we record the further progress of the two machines—both of them Vickers-Vimy-Rolls.

"The Times" Aeroplane

This machine left Khartoum at 6.35 a.m. on February 10 for Jebelein, and was sighted at Kosti Bridge at 8.10. Then followed a silence of two days, after which came the news that the machine had landed at Jebelein and then gone on, after repairing another leaking water-jacket. Then the magnetos of the starboard engine gave trouble rendering a descent necessary in a dry swamp in the thick bush north-east of Renk. Repairs occupied the whole of the day, and the crew slept in the open at night. On the 11th another leak was found on starting the engines. It was decided to return to Jebelein for repairs. On the way another—the sixth—leaking water-jacket was observed. On February 14 the journey was resumed, but the visibility was bad owing to smoke from bush fires, and the pilots lost their bearings in the bush south-west of Malakal. Capt. Cockerell sought a landing place twice and eventually came down on a khor between 15 and 20 miles north of Mongalla. The next morning Capt. Broome and Dr. Chalmers Mitchell walked to Mongalla for assistance, and the machine reached Mongalla at 4 p.m. on February 15. It was then decided to spend three days in endeavouring to put the engines of the machine in order.

The "Silver Queen" Aeroplane

The arrival of the "Silver Queen" at Heliopolis was most picturesque, as the landing was made in the darkness at 8.25 p.m. In accordance with his plan of flying by night, Col. van Ryneveld left Heliopolis at 11.36 p.m. on February 10, with the hope of reaching Khartoum. The next news was that the Silver Queen had crashed at Korosko, after a flight of about 530 miles; the machine was badly smashed, but the engines are intact. It appears that the radiator tap of the right engine opened, and in order to save the engine, Col. van Ryneveld decided to come down; unfortunately the machine ran into the only heap of boulders within 100 yards. It is proposed to take the engines back to Cairo and instal them in another machine.

The R.A.F. Machine

Another Vickers-Vimy-Rolls, piloted by Maj. Welsh and Capt. Halley, was to leave Cairo on February 19 for the Cape, and if successful the pilots intend to fly back from the Cape to Cairo.

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BOOK REVIEWS

"APPLIED AERODYNAMICS"

THE quantity of aerodynamical data now available is very considerable, but although the broad fundamental principles of flight are simple and fairly well understood, there are numerous secondary features which require very careful study. The aeroplane designer has at his disposal a fund of valuable data, mostly gained from wind tunnel experiments, but is faced with the problem of how best to utilise and apply this information. In his latest published work, entitled "Applied Aerodynamics," Mr. L. Bairstow has made it his aim—as he puts it in the preface of his book—to extract principles from, and illustrate the use of, the detailed information contained in the Advisory Committee Reports and Memoranda and other sources. This should not be taken to mean that the book is merely a reprint of these publications. Far from it. What use has been made of such reports, etc., is in the form of abstracts only, and the author has made no attempt to make a collection of the results of research. He collates rather than collects, and his book is rather to be considered as a contribution—and an exceedingly valuable one, as might be expected from a scientist of Mr. Bairstow's capabilities—to the application to industry of the data as they exist at the present time.

Opening with a description of the various classes of aircraft, the author proceeds to a statement of the elementary principles of steady flight, considering briefly the power plant and propulsive mechanism and giving simple performance curves, including some for altitude flying. Longitudinal balance is also briefly dealt with, and a reference is made to the principles of lighter-than-air craft.

The conditions of steady flight having been dealt with, the far more difficult and complicated problems connected with aerial manœuvres and the equations of motion is attacked and elucidated in as simple a manner as is consistent with the concise statement of the principles involved. The same applies to the chapter on airscrews, and also to a certain extent to those dealing with fluid motion, dynamical similarity, and scale effects. Simple performance curves having been given in the earlier part of the book, the prediction and analysis of performances are fully gone into and explained in a manner which cannot fail to assist the student very materially in attaining a closer performance estimate. The book concludes with a large and valuable chapter on stability.

"Applied Aerodynamics" is a work which no one seriously contemplating the study of this subject can afford to be without, and when aeronautics becomes a recognised subject at our universities it should take its place as a standard textbook. (Longmans, Green and Co. 32*s*. net.)

"THE DESIGN OF SCREW PROPELLERS FOR AIRCRAFT"

THIS is not, nor does the author claim it to be, a strictly logical and mathematical treatise on the subject of airscrews. It is, however, a decidedly useful work, intended, as the author points out in his preface, for those who desire to learn how to design a propeller for actual use. Propeller design is to many a subject of great intricacy, but we venture to suggest that the present book will go a long way towards elucidating the problems confronting the beginner. The author has, in our opinion, been singularly fortunate in his statement of the principles involved, neither making his book too mathematical, nor going to the other extreme of making it "popular." The result is a happy medium which cannot fail to appeal to the practical engineer and designer who wishes to be in a position to design and build his own airscrews.

The most immediately useful chapters of the book are those dealing with general terms and definitions, the simple Drzewiecki theory, aerodynamical analysis and design, and the strength of a propeller. Practically speaking, these are all that is necessary for ordinary routine design, but for those who wish to delve further into the subject there are chapters on inflow and outflow, and on the combined theory which takes into account the resulting increase in axial velocity. If it is desired to be able to estimate more correctly the efficiency of a propeller under given conditions, and to understand more clearly the various factors which influence efficiency, the chapters entitled "overall efficiency," "the flow of air through a propeller," "the effect of placing a body in the slipstream," and "general considerations," will enable the student to elaborate and extend his refinement of design to any desired extent. The subjects of tandem airscrews and variable pitch propellers are dealt with, while an appendix contains some very useful notes on getting out the actual working drawings of airscrews. The book concludes with an appendix on the construction of and materials used for propellers. (Longmans, Green and Co. 25*s*. net.)

"STREAMLINE KITE BALLOONS"

THERE is so very little collected data on the subject of kite balloons that the book bearing the above title, which Capt. P. H. Sumner has prepared, is certain of a niche on the bookshelf of those who are interested in the lighter-than-air side of aeronautics.

Just as the War, by creating the demand for large bombing machines, helped materially to develop aircraft which could be adapted for commercial work, so the War put new energy into ballooning which had come to be looked upon as a *dolce far niente* pastime—and so revolutionised its prospects as to indicate a commercial future for the kite balloon.

Capt. Sumner thinks that the naval balloon will continue in its work akin to the Coast Guard Service, and, for land operations, will remain as an asset to the artillery. New scope in commercial life will be that of the survey of large areas, while for meteorological and wireless stations balloons should be able to accomplish invaluable work. It is possible, too, that they should form effective signposts on the great airways of the future.

The author has attempted to set out a comprehensive study of the principles of stability applied to the captive balloon, in such a way as to materially assist the student of kite-balloon design, as well as help the practical balloon officer to know his craft. Capt. Sumner opens by describing the functions of the various parts which go to make-up the modern kite balloon, and then proceeds to deal with such subjects as "the streamline," "the lift diagram," "the application of dynamics for determining the equilibrium of the balloon," "longitudinal stability," "wind resistance," "internal pressure and tension in balloon materials." From the practical point of view two most useful chapters are those on "envelope construction" and "rigging." In an appendix there are a number of useful tables, aeronautical and mathematical formulæ, a glossary of technical terms, etc. (Crosby Lockwood and Co. 10*s*. 6*d*.)

CHARACTERISTICS OF DESIGN AFFECTING PRODUCTION, OPERATION, AND MAINTENANCE OF AIRCRAFT.*

By Major PERCY BISHOP, Associate Fellow

THE advent of the use of aircraft for purposes other than warfare will involve the appearance of several additional aspects into the already numerous considerations which have to be applied during the evolution of the design of an aircraft.

During the recent War, designers were called upon to produce designs in which performance and manœuvrability were the foremost considerations, and sacrifices of other factors, including safety and stability, had to be made in order to attain supremacy in these directions. It is true that during the latter stages of the War matters concerning ease of production, the use of alternative materials and accessories, and facilities for maintenance did receive a certain amount of attention; but in view of the speed at which designs and production had necessarily to mature, the amount of thought which could be given towards such considerations was very limited.

Today the aspects are considerably changed, and the following notes are prepared with a view to emphasising the importance of those factors which in the past have been restricted, but which in the future will tend to take precedence among the characteristics of aircraft. In these notes it is not proposed to touch upon the relative importance of safety, performance and stability, but rather to deal with the characteristics which interest those constantly engaged with aircraft, whether they be concerned in manufacture, operation, maintenance or repair.

The vicissitudes which aircraft are called upon to experience, even before their initial flight, are in some cases very peculiar, and unless these are catered for by the designer at the outset the industry will suffer very considerably from disappointed users, thus antagonising the class on whom it must rely for its future prosperity. It is a common experience today for an aircraft of good design and manufacture to live half its life before enjoying the pleasures of its first flight, owing to its unsuitability to endure the terrors of dismantling, storage, transport, and subsequent erection under all sorts of conditions.

There is no doubt that aircraft suffer far more depreciation when on the ground, especially when subjected to transport and re-erection, than when kept in continual flying use. In future possibly the majority of this country's output of aircraft will be exported, and consequently the above conditions will apply, not to isolated cases, but to a majority, thus emphasising the necessity of the design being so contrived that provision is made to withstand such conditions.

Apart from this, a little consideration on the part of designers and draughtsmen will very considerably ease the lot of all concerned in the production of the machine. Such consideration will always assist in reducing the cost of manufacture, accelerating production, and evolving a more serviceable machine.

Experience during the War has shown that a great saving can be effected by very careful consideration being given to preparation of detailed drawings, so as to avert such an excessive amount of alterations as attended all designs during the early stages of manufacture. It is a regrettable fact that the design of details in this country is generally left to junior draughtsmen, who as a rule possess very limited experience of shop practice or of the routine of producing organisations. This in principle is entirely wrong, as the drawings are always "key" or "pivotal" (to use a current term), and consequently demand the keenest attention and very thorough knowledge during their preparation.

Again, nearly all failures in the air are traceable to detail faults, and several otherwise excellent designs of aeroplanes have been doomed owing to detail defects.

The various aspects from which improvements in design appear to be beneficial are dealt with in the following order, which covers the stages through which the aircraft passes from its conception to its "write-off":—

1. Preparation for manufacture.
2. Manufacture and assembly.
3. Inspection.
4. Storage, packing, and transport.
5. Operation and maintenance.
6. Repairs and replacements.

* Paper read on February 18 before the Royal Aeronautical Society.

1. *Preparation for Manufacture*

The work involved in the preparation of a design for manufacture is chiefly connected with the design of details, and with the production of drawings. It may be of interest to deal briefly with general drawing procedure, especially in regard to the information which should accompany all drawings in order to facilitate the production of the part or component concerned.

In the first pla e, the drawing should be regarded as a complete specification of the article required. It should contain the following information:—

1. All necessary dimensions, with permissible errors in manufacture, including accurate development in the case of complicated bent-up parts.
2. Particulars of the material from which the part is to be made.
3. The sequence of operations necessary for the production of the part.
4. Details of any heat-treatment which may be necessary at any stage of the work.
5. Protective requirements to prevent deterioration due to atmospheric conditions.
6. Identification marks in order that the part may be identified during and after manufacture.
7. The component or type of aircraft on which the part is used.

Each drawing should be on a separate sheet of convenient size.

Many designers do not even now consider all the above information essential, and do not include such items as operations and protective requirements. Their view is that the shop staff know better how to produce the part than the designer or draughtsman; but although this is undoubtedly true in many instances today, it is contended that the process of manufacture should be considered by the designer at the time of evolving the design; and that if the design is so arranged as to require a specific method of manufacture, the particulars ought to be stated on the drawings.

Admitting the necessity for means of identifying parts, partial assemblies and components, it is essential that a suitable numbering scheme for drawings be adopted. The production problems of automobile engineering are very similar to those of aircraft, and it is almost universally agreed that the adoption of one single series of numbers for components, parts, or even pieces of parts, is the most satisfactory method of identification. This system involves a separate drawing of each part and of each piece of a part. At first sight this may seem to be a cumbersome procedure, but it proves of great assistance to those engaged in production, where attention has at certain stages of manufacture to be paid to each individual piece separately.

Take for example the case of a built-up sheet metal fitting made up of two or more pieces. For this we shall require:—

1. A drawing of the complete part as required for erection; and
2. A drawing of each piecé comprised in such a part.

It is assumed that these drawings are produced on the lines indicated above, and that the information they afford is more complete than is now usual.

Such drawings will have other advantages besides being more generally useful during actual manufacturing operations. The work of ordering and laying out will be much simplified, as the accurate development of parts or pieces can be set out in such a way as to obviate the tedious operation of laying-out in the shops by staff, whose facilities and capabilities for the geometrical and mathematical work required, can hardly compare with those of a trained staff continually engaged in such work in the drawing office.

Further, the drawings will be of material assistance to staff engaged in the stores and despatch departments. The drawings of parts, partial assemblies, and components, should each contain their respective schedules, as such information is necessary to complete the specification of the article represented. No further schedules will be required, and this is particularly advantageous in eliminating the liability of errors during the incorporation of modifications which involve alterations to both schedules and drawings. Such modifications are inevitable during the experimentsl stage of aircraft manufacture. The system also has the advantage that it

leads automatically to standardisation, whether of pieces, parts, or components.

Considerable economy of material, of machining, of labour, and of temper, can be effected in the preparation of detailed drawings by calling for current available materials, and utilising, as far as may be possible, standard sizes of bars, sheets, and tubes. Each detail should be so arranged that it may be produced economically from such standards. If the requisite sizes of bars, sheets, etc., be named on the drawings the information will be useful from a buying and store-keeping point of view.

This point may be made clear by an example or two. For instance, parts such as turnbuckles, forked-ends, engine valves, spindles, etc., which are usually produced in quantity on automatic machines, should be preferably arranged so that the maximum diametric dimension falls just inside the standard bar diameter. This will reduce to a minimum the removal of redundant material for the whole length of the part before the forming is commenced, and will thus do away with waste of material and needless wear of cutting tools.

Another example is that of a tank, in which, if the maximum width of sheet from which the shell, the ends, or the baffles, are made, falls just outside the standard size of sheet, the result is either a larger sheet being cut uneconomically, or the introduction of an additional seam in the construction of the tank.

Propeller laminæ, long spars, *longerons*, and struts, also frequently give rise to difficulty in manufacture owing to timber being unavailable in the required dimensions. There is then no alternative but to introduce joints, which are expensive to make and unsatisfactory in themselves.

The drawings should also specify carefully the permissible limits of error in manufacture, whether these are required to safeguard the strength of a part or to secure interchangeability. In determining such limits consideration should be given to tolerances necessary for the various manufacturing operations. In the case of interchangeability, additional consideration is necessary to provide sufficient "allowance" for error in gauge manufacture; and in some cases yet further allowances must be made for small errors in the manufacture of master gauges. This matter is of particular importance in the case of hinges or joints at the junctions of components where interchangeability is essential. Frequently the dimensions in these cases are large, and errors in manufacture are correspondingly increased. In such cases it is not sufficient to arrange the limits, so that the parts shall in theory assemble where one part is on the high limit and the other on the low.

In the case of wooden parts allowance must also be provided for shrinkage of timber and distortion.

The whole question of limits is very involved, and can only be briefly touched upon in this paper, but in order that the drawings may be complete, the statement of limits must be such as to constitute legal evidence of the requirements, both on the part of the supply contractor and as affecting the manufacturing or erecting shop staff when payment is made on a piece-work basis.

2. *Manufacture and Assembly*

The cost of production has received little consideration in the past as a factor in the design of aircraft, but with the development of aircraft for commercial purposes it has been realised that serious attention must be given to it.

The phases passed through since the conception of heavier-than-air flying machines make an interesting study. Most of the pioneers of flying had but limited resources for making and building their experimental machines. Accordingly the fittings they designed were generally arranged in the simplest possible way, and produced at the least expense.

Later on, when flying became more general, experiments were no longer embarrassed by lack of financial assistance. Designers then began to use the best material and labour available, and concentrated their attention on reducing resistance and weight to a minimum; thereby improving performance, without eliminating any of the necessary requirements for safety.

It is perhaps fortunate that the development of aircraft passed through such a stage so early in its career, especially as the burden did not fall on the industry itself. It enabled the essential qualities combining to ensure safety and good performance to be developed very rapidly.

The next phase is that of a compromise, and represents the one which interests the industry today; the problem being to reduce the cost as far as possible by designing to suit manufacturing facilities generally, without any retrogression from the advance arrived at in safety and performance. It is proposed to pass this stage under review and to show how some at least of the manufacturing difficulties may be eased.

The extensive use of fittings made from sheet metal, which can be punched out correctly to shape, and which require but few subsequent operations to complete manufacture, is undoubtedly a progressive stage towards this end. Such a method of production is considerably cheaper than that of using forgings and stampings, with the unavoidable subsequent machining. Until quite recently there was much prejudice against the use of sheet metal pressings; this arose from the assumption that the punching operation produced cracks of a dangerous character upon the sheared edges, but it has been found that this danger can be avoided by taking certain precautions, namely, the trimming-up of all edges where stress is likely to occur, and the removal of small cracks which might develop and cause trouble. For small holes the punching operation should be always followed by drilling or reamering.

In adopting such a method of production the standardisation of shapes of parts, or pieces of parts assists very materially. The cost of die-making and setting-up represents a very high percentage of the total cost, and consequently the number of shapes required should be kept down to a minimum. This can be achieved by so arranging the shape of a blank that other shapes may be cut from it by means of another shearing operation to cut away the redundant portion.

Another feature which perhaps has not been realised is the fact that the manufacture is simplified in the case of "right-hand" and "left-hand" parts. The blanks are always flat at this stage of manufacture, and the subsequent bending operation will determine the "hand." In the case of stampings, two dies are usually necessary, which not only involves setting-up the dies twice, but also duplicates the number of jigs and subsequent operations.

The use of sheet metal fittings has the further advantage that the sheet from which the blanks are punched serves excellently as the locating portion of a jig for subsequent operations on the blank, such as drilling, etc.

Another important advantage of sheet metal construction which is particularly evident today is that it suits manufacturing conditions, no matter whether large quantities of the same part are required or merely the number necessary for one experimental machine. If the quantity does not justify the making of press tools, the blanks can readily be "nibbled" out from sheets at extremely low cost.

The combination of a number of blanks, bent to desired shapes and connected together by rivetting, welding or brazing, is quite a cheap method of manufacture. In designing such fittings care must be exercised to ensure that the process of normalising the material to remove strains, caused through bending or welding, is capable of being carried out, without involving prohibitive distortion of the final shape required.

From the manufacturer's point of view standardisation is of the utmost importance, and too much stress cannot be laid on the necessity of giving it the utmost consideration in the early stages of the design of detail parts. Holes, screw threads, angles, tapers, and even radii of corners (where a machining operation is required), should be of standard dimensions, and the minimum variety of such sizes consistent with efficiency should be called for. This will result in limiting the number of sizes of drills, taps, dies, broaches, reamers, gauges, spindle tools and cutting tools generally; and also in some cases in an economy of setting-up operations.

The average number of tools and gauges required when manufacturing any particular design today, is unnecessarily high, and can be materially reduced without detriment to the efficiency of the machine itself.

In the design of covered components, one of the most prevalent difficulties which occur in manufacture is that of distortion, and it is essential that the structure should receive consideration from this point of view in the design. The strains of fabric doping, initial tension in bracing wires, shrinkage of timber, and bedding-down of metal fittings on to timber, all tend towards distortion, which hampers quick erection, destroys interchangeability, and may well result in rendering the component unserviceable.

One of the greatest difficulties of erection experienced today occurs at the latter stages of assembly, and that is the large extent of hand fitting which is necessary in the fitting of cowlings, connecting-up of pipings, controls, and the fitting of accessories generally. This is due to the fact that drawings are usually not considered necessary for such parts, and the design is left to the shop staff to decide at the time of erection. The contention is that complete drawings should be made of all parts, and more particularly that the

operation of assembly should then receive attention. If the dimensions of such parts are difficult to determine on paper, the use of "mock-ups" should be resorted to for this purpose. This practice also usually tends to the devising of more satisfactory arrangements, as regards both erection and functioning.

It is possible to incorporate in the design many other features which will simplify the erector's work and permit of increased accuracy in truing-up. As instances, fittings may be made self-aligning by means of universal joints or in other ways; strut fixings, wiring plates, etc., may have their securing pins arranged to hinge in the most convenient plane for lining-up; and multiple connections (hinges, for example) may be arranged to register on one of their number with ample clearance in the remainder.

3. *Inspection*

The future of British aircraft depends very largely upon the maintenance of their acknowledged existing supremacy as regards both safety and reliability. This position has been won, firstly by sound design, both structural and aerodynamic, and secondly by ensuring that the actual aircraft comes into existence and continues to exist in the form intended by the designers.

It is clear that the first requirement necessary for carrying out any examination is adequate access to all important members and organs of the aircraft.

One of the peculiarities of aircraft design is that the performance very largely depends on securing clean uninterrupted exterior surfaces, and on the stream-lining of shapes which would otherwise increase head resistance; thus all structures and mechanism tend to become hidden from external view by cowlings, coverings, fairings, etc. There is, however, no reason why such coverings should not be made easily detachable, or other provision made for purposes of inspection, without incurring any appreciable increase in head resistance.

It is realised that in the special case of planes this procedure is in practice prohibitive. When doubt arises as to the airworthiness of a plane which has been a long time in store, or has been transported from place to place, it may be necessary to strip and recover the component.

In any case, however, the more vital parts should be easily accessible, so that periodic examinations and adjustments may be carried out. Such inspections are demanded daily by the Air Navigation Regulations before passenger flights may be made, and provision should, therefore, be made to enable the ground engineer to satisfy himself of the safety of the aircraft in the shortest possible time.

One of the most important items in construction is the control mechanism, which should be carefully studied in this connection. Where controls are carried inside planes, doors or windows should be provided to view all pulleys, levers, and connections, in order that correct alignment, security of attachment, and wear of cables can be safeguarded. Such inspection doors or windows should be so arranged that the whole of the run of the cables can be examined through them, in order to see that they run clear of obstacles such as ribs, struts, cross-bracings, etc.

To facilitate the attainment of these conditions sight holes or gaps should be employed to ensure :—

(*a*) The correct bedding of struts in sockets or on to other members;

(*b*) Sufficient length of engagement of screwed parts;

(*c*) The correct positioning of internal blocks in hollow built-up spars or other main members, as for example those constructed on the "McGruer" system.

Unless some such provision be made it is impossible, once the parts have been erected, to discover if these points have been attended to.

Particularly in the case of the power plant installation, periodic inspection is essential on account of the prevalence of leaks in petrol, water, and air systems, and the breaking or "shorting" of ignition wires caused through vibration or landing shocks. It is, therefore, absolutely necessary that the question of accessibility should be given the utmost weight. Improvements, in the form of quickly detachable cowlings, provision of sufficient inspection doors locally to petrol cocks and connections, or arrangement of the pipe lines or run of engine controls in such a way that they may be easily inspected, are essential.

Whilst dealing with the question of installation piping, it appears opportune to emphasise the importance of marking the various pipes for identification purposes. There is a standard method of painting the various pipes to denote whether they are for oil, water, air, or petrol, *viz.*, red for petrol, yellow for compressed air, black for oil, blue for water, white for air speed tubing, and yellow and red for air pressure for petrol feed—and such first-sight distinction is an invaluable asset when checking a complicated installation system.

The work of an inspector can also be facilitated by the elimination as far as possible of such processes as welding, brazing or soldering, especially where the strength or security of the parts so treated is important. It is obvious that, after the operation has been performed, such a process cannot be certified as having been correctly carried out. Moreover, a selective test to destruction is not considered a sufficient guarantee, owing to the great degree of variation which can occur in such processes. Even with the "dip brazing" method the retention of the correct analysis of the brazing metal cannot be guaranteed, as the difference in the melting temperatures of the ingredients causes the zinc to evaporate away faster than the copper, so that even with frequent additions of zinc, and check tests at each addition, the constitution of the bath cannot be regarded as even approximately uniform.

A difficulty experienced in checking the truth of erection of an aircraft is to find datum surfaces or points from which to begin the series of check measurements. The provision of a horizontal cross and longitudinal member at some convenient point in the structure will serve to establish a level in both directions, and allow measurements to be based on this datum.

4. *Storage, Packing and Transport*

The difficulties encountered in the storage, packing, and transport of aircraft components, and the consequent damage experienced during recent years, have been very great. The principal reasons are :—

Firstly, the fragility of the parts, necessitating the most careful methods of handling, packing, and storing;

Secondly, the sizes and awkward shapes of the components and parts demand a large amount of space, both for storage itself, and as adjustment room for manipulation in the store; and

Thirdly, the difficulty of supporting the component or part when stored or packed to prevent damage due to chafing or distortion.

To meet such contingencies there appear to be two alternatives; on the one hand to provide special packing-cases for each of the components or parts, which would render them immune from such damage; or on the other hand, to relieve the situation by refraining from the use of such fragile or large components, and make special provision in the way of supports, etc.

The first alternative would obviously be impracticable as a general measure, on account of the excessive cost involved in making the cases, although in certain cases such as engines, propellers and instruments, such practice is unavoidable. The second alternative can, however, be taken advantage of to a large extent, provided consideration is given to the question at the time of design.

The average covered component is incapable of being stored, packed, or transported, without receiving injury of some nature, owing to the impossibility of supporting it at favourable positions of its structure.

The addition to such a component of some form of projections by which it could be supported or secured would be invaluable from a transport and storage point of view. In addition, the designer would then know definitely the conditions to which the component would be subjected, and could arrange the local members of the structure to take the corresponding stresses.

The adoption of permanently built-up structures such as undercarriages, V-struts, cowlings, and fairings, should be avoided as far as possible to meet this end, and such forms should be superseded by structures which could readily be dismantled to convenient sizes and shapes for storage and transport purposes.

The limitation of sizes of components should be governed by the conditions of existing methods of transport, where such restrictions as heights of bridges, lengths of trucks, lorries, or trailers, have to be complied with. Considerable difficulty in transport has already been experienced in this direction, and the existence of prohibitive sizes of components has frequently led to extensive trouble and excessive cost in arranging transport. It becomes evident, therefore, that large components such as planes and *fuselages* should be capable of being dismantled to a more convenient size. In the case of planes with long chord measurements this could be effected by provision of detachable trailing portions, and long planes or *fuselages* could be made in sections with suitable jointing arrangements.

The use of detachable projections, such as levers and king posts, on covered components should also be encouraged with a view to meeting storage and transport facilities.

The storage of complete aircraft has been facilitated considerably by the development of folding wing arrangements, and it is encouraging to see that this practice is now being extended to small aircraft.

The deterioration of tyres during storage is possibly a point worth referring to under this heading, and even if it were considered that the incorporation of stands in the undercarriage design would be too great an encumbrance, the provision of suitable surfaces against which a jack or lever could bear would greatly facilitate the lifting operations, and enable blocks to be inserted to take the load off the tyres.

5. *Operation and Maintenance*

The life of aircraft is a more vital matter in the case of machines required for civil purposes than in warfare. Fighting machines require to have all up-to-date improvements embodied in them at the earliest possible moment, and thus existing designs quickly become obsolete because they are out of date, rather than because they are worn out. Further, financial considerations affect civil aircraft very closely, as the rate of depreciation in value must be reduced as far as possible.

It is most important, therefore, that the question of wear and tear should receive attention at the time of design, and it is proposed to deal briefly with the conditions which largely contribute to depreciation, and to show how some of them may be ameliorated.

Deterioration is to a very large extent attributable to atmospheric conditions, but it is considered that another important factor is that of damage and small accidents due to bad handling, climbing about the machine, and want of skill or care in the manipulation of the machine when on the ground and in hangars.

The life of the engine itself naturally depends to a very large extent on the length of its working hours, periodic attention, etc., but at the same time it, too, may be considerably affected by the treatment and conditions to which it is subjected, when not actually in use during flight.

The uses made of some of the structural members during handling or climbing about the machine would, if known to the designers, relieve them of a large amount of mathematical calculations. Such calculations are based on the assumption that the members and parts have to withstand only those stresses incurred in flying and alighting. As a matter of fact, parts which are amply strong on such an assumption may, and do, fail miserably under the unfair stressing they suffer during the handling of the machine on the ground.

It appears then that efforts will have to be made by designers to eliminate the liability of such "wear and tear" by utilising fool-proof devices to meet such contingencies. It must be remembered that the handling of the machine or its components is most frequently carried out by unskilled labour. In the case of a covered component in which the principal members are hidden, it is necessary either to give precise directions for handling, or, better still, to make the operation fool-proof by the provision of handles. Attachments such as these need not necessarily be an encumbrance to the machine either from the point of view of weight or resistance, provided they are carefully considered when designing the component.

Provision of steps and treads, not only for entering the machine but also for the use of riggers and mechanics when carrying out adjustments, is essential, and if duly considered in the early stages of design would enable the designer to arrange for local stiffening in order to carry the loads imposed under such conditions.

As the operations of replenishing fuel, lubricant and water, and of adjusting the power plant, cannot usually be performed from the ground, it is mainly for these purposes that men climb on to aircraft. The treat axles, radius rods, exhaust pipes, and struts as platforms, and bracing wires, fairings, and the like as banisters. Apart from the question of unfair stressing, which has already been touched upon, the said objects are never really successful in these more humble capacities. Consequently there is every reason why proper handholds and footholds should be provided.

Whilst dealing with the question of replenishing petrol, oil, and water—at present a rather long and highly inconvenient operation—a strong plea is put forward for larger filling an emptying apertures, and for their arrangement in less awkward situations. It is suggested that filling from underneath has many advantages, both as regards convenience and the avoidance of air-locks in pipe systems.

The deterioration which may take place owing to atmospheric conditions demands considerable attention on the part of the designer, apart from the specifying of protective processes. These processes include painting, varnishing, pigmenting, a special process for metal parts, such as "Coslettising" and "Sherardising," and the use of non-corrosive materials. Attention should also be given to drainage arrangements in planes and *fuselages*, the sealing of hollow tube members, axles and struts, and the general avoidance of pockets and corners where moisture would collect. This is particularly important in the vicinity of glued-up wooden constructions such as ply-wood, built-up ribs and spars.

In this connection it almost seems desirable that covers for exposed parts such as engines, propellers, and open cockpits, should be included in the design, and provision made for their accommodation in the machine. These essential accessories are rarely available when required, and the tendency is to provide them as an afterthought.

6. *Repairs and Replacements*

In view of the necessity of saving as much redundant weight as possible above that actually required to fulfil safety conditions in the design of aircraft, occasional minor accidents will inevitably occur when subjecting a machine to abnormal conditions such as landing in bad weather, or by forced landings in places with bad surfaces and obstructions.

To cope with such accidents it is necessary that the work of repairing machines should be facilitated as far as possible to avoid their being out of commission for unduly long periods, and to permit the damaged parts to be replaced without involving an excessive amount of work.

The designer can materially assist in arriving at such conditions by developing on standardisation lines throughout the design. It is encouraging to note that great advances have been made in this country during and even previous to the War, as regards rigging attachments, piping connections, bracings, etc., and generally the smaller parts which are common to most types of aircraft; but there is still ample room for further development in other parts, such as *fuselage* sockets, plane attachments, wiring plates, struts and fittings, to name only a few.

Even in the case of complete components there appears to be room for further standardisation, and in one case this has been taken advantage of to a very large extent by arranging the design of the *ailerons*, elevators, and rudders so that they are all interchangeable. Such advances reduce the quantity of spares required, which is a very important item.

An advantage of standardisation especially concerning rigging attachments, which perhaps has been overlooked but which is considered to be of great value, is the fact that in making replacements the danger of substituting parts under the required strength is practically eliminated, as a part of incorrect size will not assemble on the adjacent fitting. It also has the advantage that in making new fittings, or verifying the strength of an existing fitting, the load to which the part should stand can be picked up from a knowledge of the strength of the standards without involving extensive calculations.

Repairs can also be facilitated by reducing to a minimum the amount of dismantling or stripping necessary to enable the replacement or repairing operation to be carried out. Particular offenders in this direction are continuous *longerons*, fittings which require to be slid on a member from the end instead of straddling it, fittings secured by rivets, or other permanent fixings, parts built up in position, and welded or brazed up structures. Seaplane hulls and floats are also typical instances where repairs are very extensive operations, even for rectifying the slightest damage.

One of the greatest liabilities to danger in making replacements is the difficulty of determining the correct material from which the replaced part should be made, and it is contended that in cases where high tensile steel is used some provision should be made to enable the material to be readily identified. Indeed, any case of employment of a special material, not readily distinguishable at sight from that commonly used, calls for such treatment.

The author remembers one case where the designer had used a bolt of the standard dimensions, but in view of the excessive load which came upon it he had resorted to the use of a higher grade material to obtain the necessary strength. It happened that elsewhere on this particular machine there were standard bolts of the same size but of standard material. Naturally, at a later date, after overhaul, the bolts became mixed, and the structure collapsed in the air with fatal results.

The provision of instructional notices containing information as to piping and wiring diagrams, rigging dimensions, doping schemes, and warnings generally, placed in convenient positions on the machine, is invaluable to those who have to attend to repair and maintenance generally, and it is strongly urged that this practice be encouraged by the designers in order that their designs shall not be abused.

THE ROYAL AIR FORCE

London Gazette, February 6.

Permanent Commissions

Flight-Lieut. W. H. L. O'Neill, M.C. (S.O.), is granted a permanent commn. in rank stated; Aug. 1, 1919.

Sqdn. Ldr. A. R. Stanley-Clarke, M.C. (A.), resigns his permanent commn.; Feb. 4.

The notification in *Gazette* Aug. 1, 1919, appointing Maj. E. Powell, O.B.E. (T.) to a permanent commn. is cancelled.

Flying Branch

Second Lieutenants to be Lieutenants:—J. Platt; Oct. 26, 1918. R. Hayward; Oct. 28, 1918. R. C. Williams; March 1, 1919. J. Silvester (since granted short service commn.), D. Thomson (since demobilized); March 26, 1919. N. Burke; May 28, 1919. E. H. Attwood; May 30, 1919 (since granted short service commn.); F. W. Hatton; July 5, 1919. W. E. Hall; July 8, 1919. S. Leigh; July 11, 1919. H. E. Y. Carroll; July 12, 1919. L. F. Mead; July 16, 1919 (since demobilized).

Pilot Officers to be Flying Officers:—E. H. Covell; Aug. 7, 1919. H. Sharkey; Aug. 21, 1919 (sinced demobilized); T. Whittaker; Sept. 7, 1919. J. A. Barber; Sept. 17, 1919 (since demobilized): P. J. O'Brien; Oct. 12, 1919 (since demobilized).

The following relinquish their temp. R.A.F. commns. on return to Army duty: Lieut. W. H. Raikes (Lieut., W. Ont. R.); Jan. 1, 1919. Sqdn. Ldr. F. J. L. Cogan (Maj., R.F.A.); Dec. 29, 1919. Wing Comdr. D. G. Conner, O.B.E. (Maj., R.F.A.); Jan. 24. Pilot Officer C. N. Poynton, M.C. (Lieut., R.G.A.); Jan. 27.

The following Lieuts. relinquish their commns. on ceasing to be employed: A. D. M. Lewis; April 17, 1919. E. F. Howard, M.C. (Lieut., R.H. and R.F.A.); April 19, 1919. J. E. Phelps; Oct. 10, 1919.

(Then follow the names of 43 officers who are transfd. to the Unemployed List under various dates.)

The following Lieuts. relinquish their commns. on account of ill-health, and are permitted to retain their rank:—J. C. Trulock (R.F.A., S.R.) (contracted on active service); Jan. 27. V. T. Kelly (contracted on active service); Jan. 29. I. C. MacGregor (caused by wounds), C. W. Middleton (contracted on active service); Jan. 31. C. Knowles (caused by wounds); Feb. 2.

The rank of Lieut. (Hon. Capt.) W. R. Kempson is as now described, and not as stated in the *Gazette* of April 1, 1919.

The initials of Sec. Lieut. B. M. Murray are as now described, and not as stated in the *Gazette* of Jan. 2.

The initials of Sec. Lieut. M. J. Ward are as now described, and not as stated in the *Gazette* of Oct. 21, 1919.

The surname of Lieut. E. Travers-Smith is as now described, and not as stated in the *Gazette* of July 29, 1919.

The surname of Lieut. T. Usher is as now described, and not as stated in the *Gazette* of May 16, 1919.

The surname of Sec. Lieut. A. B. Llewellyn-Williams is as now described, and not as stated in the *Gazette* of July 4, 1919.

The surname of Sec. Lieut. O. B. Santa-Maria is as now described, and not as stated in the *Gazette* of July 25, 1919.

The surname of Sec. Lieut. E. H. Weatherell is as now described, and not as stated in the *Gazette* of April 29, 1919.

The surname of Sec. Lieut. G. T. Witcombe is as now described, and not as stated in the *Gazette* of May 2, 1919.

The surname of Sec. Lieut. E. E. Wilby is as now described, and not as stated in the *Gazette* of April 25, 1919.

The notification in the *Gazette* of June 10, 1919, concerning Lieut. H. J. Paine is cancelled.

The notification in the *Gazette* of July 8, 1919, concerning Sec. Lieut. (Hon. Lieut.) D. G. O. Hepworth is cancelled (notification in the *Gazette* of May 27, 1919, to stand).

The notification in the *Gazette* of Nov. 28, 1919, concerning Sec. Lieut. (Hon. Lieut.) J. E. Radley is cancelled (notification in the *Gazette* of Jan. 20 to stand).

The notification in the *Gazette* of May 30, 1919, concerning Sec. Lieut R. W. Willis is cancelled (notification in the *Gazette* of May 20, 1919, to stand).

The notification in the *Gazette* of June 13, 1919, concerning Lieut. R. G. Smith (Lieut., Manitoba R.) is cancelled.

The notification in the *Gazette* of May 27, 1919, concerning Lieut. N. H. Raikes (Lieut., W. Ont. R.) is cancelled.

The notification in the *Gazette* of May 13, 1919, concerning Lieut. N. R. D. Henderson (Lieut., Manitabo R.) is cancelled.

Administrative Branch

Pilot Officers to be Flying Officers:—W. R. Castings, M.B.E.; Oct. 1, 1919 (previous *Gazette* notifications to stand); T. F. Kingston; Oct. 24, 1919. J. R Brown; Oct. 27, 1919.

The following relinquish their temp. R.A.F. commns. on return to Army duty:—Lieut. R. G. Smith (Lieut., Manitoba R.); Dec. 9, 1918. Lieut. W. R. W. Henderson (Lieut., Manitoba R.); Jan. 25, 1919. Capt. F. H. Bacque (Capt., Can. R.); July 31, 1919 (substituted for notification in the *Gazette* of Jan. 27). Flight-Lieut. M. H. Toy (Capt., Can. Gen. List) (substituted for notification in the *Gazette* of Jan. 27); Aug. 4, 1919.

(Then follow the names of 17 officers who are transfd. to the Unemployed List under various dates.)

Sec. Lieut. W. A. Johnston relinquishes his commn. on account of ill-health (contracted on active service), and is permitted to retain his rank); Jan. 31.

The surname of Sec. Lieut. F. W. Weekes is as now described, and not as stated in the *Gazette* of April 11, 1919.

Technical Branch

Sec. Lieuts. (Hon. Lieuts.) to be Lieuts., Grade (B):—P. J. Burns (since demobilized), T. B. Jones (since demobilized) (substituted for notification in *Gazette*, March 7, 1919); April 2, 1919.

Pilot Officers to be Flying Officers, Grade (A):—A. E. Case (since granted short-service commn.), C. H. V. Hayman, G. T. H. Pack (since granted short-service commn.); Oct. 1, 1919.

Pilot Officers to be Flying Officers, without pay and allowances of that rank:—E. W. T. Crouch, C. Knowlson; Oct. 1, 1919.

Sec. Lieut. J. Roberts retires on retd. pay, and is permitted to retain his rank; Jan 1.

(Then follow the names of 18 officers who are transfd. to the Unemployed List under various dates.)

The surname of Lieut. (actg. Capt.) C. L. Willcox is as now described, and not as stated in *Gazette* March 7, 1919.

The notification in *Gazette* Dec. 16, 1919, concerning Capt. A. P. Thurston is cancelled (notification in *Gazette* July 15, 1919, to stand).

The notification in *Gazette* Oct. 24, 1919, concerning Lieut. D. A. Parker is cancelled (notification in *Gazette* Nov. 21, 1919, to stand).

Memoranda

(Then follow the names of 11 Cadets granted hon. commns. as Sec. Lieuts.)

The following temp. Hon. Lieuts. relinquish their commns. on ceasing to be employed:—J. C. Kernot; May 17, 1918. D. D. Baird; Nov. 7, 1918. L. Eynon, M. Toombs; Dec. 16, 1918. E. Gough; Jan. 16, 1919. A. E. Kitsell; Feb. 16, 1919. C. J. Walters; March 16, 1919. W. G. Edwards; March 18, 1919. P. A. Meluish; June 16, 1919. W. G. Manley; Oct. 16, 1919. A. H. Fox, L. W. Hill, A. R. Pettet, N. Rowbotham, H. A. Thomson, W. Williams, H. S. Wonham; Jan. 15.

(Two officers transfd. to the Unemployed List.)

Sec. Lieut. C. B. Bousfield relinquishes his commn. on account of ill-health, and is permitted to retain his rank; Jan. 31.

London Gazette, February 10

Flying Officer G. F. Law (S.O.) is granted a permanent commn. in the rank stated, with a view to transfer to the Stores Branch when formed; Aug. 1, 1919.

Flying Branch

Flight-Lieut. (actg. Sqdn. Ldr.) D. G. Donald, A.F.C., relinquishes actg. rank of Sqdn. Ldr. on ceasing to be employed as Sqdn. Ldr. (A. and S.); Dec. 24, 1919.

Flight-Lieuts. to be Flight-Lieuts. (A.), from (S.O.):—A. Rowan; Jan. 16. G. J. C. Maxwell, M.C., D.F.C., A.F.C.; Feb. 1.

Lieut. H. Faull is graded for purposes of pay and allowances as Capt. whilst employed as Capt. (A.) (from June 18, 1919, to Aug. 14, 1919.

Second Lieutenants to be Lieutenants.—(Hon. Lieut.) H. J. Collins (since granted short service commn.); April 12, 1918. A. E. Tweed; July 1, 1918 (since demobilised). W. L. Roberts; Sept. 7, 1918. R. T. Carter; Oct. 15, 1919 (since granted short service commn.). S. Moyles; Nov. 4, 1918. J. Davidson; Nov. 9, 1918 (since demobilised). E. G. T. Chubb, L. P. Jackson (since demobilised); Feb. 12, 1919. A. E. Watson; Feb. 14, 1919. P. Loftus; March 3, 1919. W. M. Tait; March 27, 1919 (since demobilised). T. L. Lowe; May 28, 1919 (since granted short service comn.). E. O. Humphries (since demobilised), S. T. Tipper (since demobilised); June 20, 1919. A. P. Murray; July 10, 1919. A. D. L. Carroll; July 24, 1919 (since granted short service commn.).

Pilot Officers to be Flying Officers:—W. H. L. Oxland; Aug. 21, 1919 (since granted short service commn.). H. Rowlands; Sept. 1, 1919. R. P. Arliss, P. J. O'Donnell, A. St. C. O'Leary; Sept. 3, 1919. C. O. Rigden, Sept. 7, 1919 (since granted short service commn. G. C. W. Dufty; Sept. 13, 1919 (since granted short service commn.). G. W. Wilson; Nov. 8, 1919 (since granted short service commn.).

Pilot Officers (O.) to be Observer Officers:—C. Sweetman; Aug. 16, 1919. T. M. Pratt; Aug. 20, 1919 (since demobilised).

The following Canadian Cadets are granted temp. commns. as Sec. Lieuts. (A.):—W. B. Mutch, D. V. MacDonald, J. W. R. Newson, R. T. Phillips, W. R. Twigg; Oct. 17, 1918.

P.F.O. E. D. Warren (late R.N.A.S.) is granted a temp. commn. as Sec. Lieut. (S.); Oct. 18, 1918 (since killed).

Sqdn. Ldr. P. C. Sherren, M.C., is placed on half-pay list; Feb. 9.

The following relinquish their temp. R.A.F. commns. on return to Army duty:—Lieut. H. S. Taylor, M.M. (Lieut., N. Scotia R.); Dec. 7, 1918. Lieut. C. B. Andrews (Lieut., North'd. Fus.); June 3, 1919. Lieut. R. S. Hall (Capt., Norf. Yeo., T.F.); June 20, 1919. Flying Officer I. H. P. McEwen (Capt., Sea. Highrs.); Jan. 7. Flying Officer H. A. Tracey (Lieut. S. Wales Bord.); Jan. 21. Pilot Officer (Hon. Flying Officer) F. V. Le Pavoux, M.C. (Lieut., K.R. Rif. C.); Feb. 5.

Lieut. C. H. Howell relinquishes his commn. on ceasing to be employed, and is permitted to retain his rank; Jan. 25.

(Then follow the names of 51 officers who are transfd. to the Unemployed List under various dates.)

The following Lieuts. relinquish their commns. on account of ill-health and are permitted to retain their rank:—A. E. Flynn; Dec. 23, 1918 (substituted for notification in *Gazette* of Nov. 29, 1918). L. G. B. Spence (caused by wounds); Feb. 2. J. Hunt, P. Kent (contracted on active service); Feb. 3. J. Chesters (caused by wounds), E. J. T. Moore (contracted on active service); Feb. 4. Lieut. A. L. Greer relinquishes his commn.; April 4, 1919.

Lieut. C. H. C. Hawkes is dismissed the Service by sentence of a General Court-Martial; April 12, 1919.

The name of Capt. Charles Ambrose Lewis is as now described, and not C. A. Lewis, M.C., as stated in *Gazette* of Jan. 20.

The notification in *Gazette* of Aug. 20, 1918, concerning Lieut. R. Turner is cancelled.

The notification in *Gazette* of Nov. 11, 1919, concerning Capt. J. N. Wilson A.F.C., is cancelled.

The notification in *Gazette* of July 15, 1919, concerning Capt. J. Hodson is cancelled. (Notification in *Gazette* of July 1, 1919, to stand.)

The notification in *Gazette* of March 7, 1919, concerning Lieut. C. H. Howell is cancelled.

The notification in *Gazette* of June 3, 1919, concerning Lieut. A. L. Greer is cancelled.

The notification in *Gazette* of July 8, 1919, concerning Sec. Lieut. O. D. E. Hillsdon is cancelled. (Notification in *Gazette* of July 11, 1919, to stand.)

The notification in *Gazette* of Sept. 9, 1919, concerning Sec. Lieut. C. H. Howitt is cancelled. (Notification in *Gazette* of Aug. 29, 1919, to stand.)

The notification in *Gazette* of Oct. 10, 1919, concerning Lieut. H. S. Crees is cancelled.

Administrative Branch

Sqdn. Ldr. F. V. H. Mackenzie to be Sqdn. Ldr., from (S.O.); Sept. 23, 1919.

Flight-Lieut. G. B. Chainey, O.B.E., relinquishes the grading for pay and allowances as Sqdn. Ldr. on ceasing to be employed as Sqdn. Ldr.; Jan. 29.

Lieut. C. H. Clifford to be Lieut., from (A.); Nov. 5, 1918.

Second Lieutenant to be Lieutenants.—G. W. C. Dawson; Oct. 2, 1918 (since demobilised). T. J. McL. Davies; Dec. 27, 1918 (since demobilised). C. E. Briant; April 16, 1919 (since demobilised).

Pilot Officers to be Flying Officers:—C. H. Cutting; Aug. 7, 1919. E. McM. Spinney; Aug. 27, 1919 (since demobilised). R. N. Walter; Oct. 5, 1919.

Pilot Officer G. W. C. Dawson to be Pilot Officer from Unemployed List; Dec. 20, 1919, with prec. next below Pilot Officer F. E. Winter.

(Then follow the names of 14 officers who are transfd. to the Unemployed List under various dates.)

Capt. H. McDonnell relinquishes his commn. on account of ill-health (contracted on active service), and is permitted to retain his rank; Feb. 3.

Lieut. J. S. Archer relinquishes his commn. on account of ill-health contracted on active service, and is permitted to retain his rank; Feb. 3.

Placed on the Retired List:—Pilot Officer A. W. Harris; Jan. 8. Flying Officer W. H. D. Phillips; Feb. 11.

The notification in *Gazette* of July 15, 1919, concerning Lieut. A. E. Kennedy is cancelled. (Notification in *Gazette* of Dec. 30, 1919, to stand.)

The notification in *Gazette* of April 18, 1919, concerning Sec. Lieut. C. Wallace is cancelled.

Technical Branch

Sec. Lieut. T. F. Morris to be actg. Capt. whilst employed as Capt., Grade (B.) from Aug. 22, 1918, to Feb. 24, 1919.

Flying Officer A. J. Somers to be Flying Officer, Grade (B.), from (S.O.); Nov. 14, 1919 (substituted for notification in *Gazette* of Jan. 20.

Pilot Officers to be Flying Officers, without pay and allowances of that rank:—J. E. Clarke, W. Fenton, E. J. Wright; Oct. 1, 1919.

Flight-Lieut. D. Cotton (Eng.-Lieut., R.A.) relinquishes his temp. R.A.F. commn. on return to naval duty; Jan. 26.

(Then follow the names of 28 officers who are transfd. to the Unemployed List under various dates.)

Lieut. E. G. Webber relinquishes his commn. on retirement from the Army; Dec. 31, 1919 (substituted for notification in the *Gazette* of Jan. 30, 1919).

The surname of Sec. Lieut. (Hon. Lieut.) C. C. Clark is as now described and not as stated in the *Gazette* of Jan. 13.

Medical Branch

Capt. F. C. Kempson to be actg. Maj. whilst employed as Maj.; July 28, 1919.

Flight-Lieut. A. S. Glynn to be actg. Sqdn. Ldr. whilst employed as Sqdn. Ldr.; Aug. 5, 1919.

(Four officers transfd. to the Unemployed List.)

The notification in the *Gazette* of Nov. 26, 1918, concerning Capt. C. Salkeld is cancelled.

Memoranda

(Then follow the names of 21 Overseas Cadets who are granted temp. commns. and 6 Cadets granted hon. commns. as Sec. Lieuts.)

The following relinquish their temp. hon. commn. on ceasing to be employed:—Maj. F. H. Bramwell; Jan. 4. Capt. A. S. Ellerton; Jan. 15.

(One officer transfd. to the Unemployed List.)

Flight-Lieut. A. C. Bolton, M.C., is placed on the retired list on account of ill-health; Feb. 2.

London Gazette, February 13.

Flying Branch

Second Lieutenants to be Lieutenants:—(Hon. Lieut.) H. F. Gorman; May 24, 1918. (Hon. Lieut.) C. C. Loretto; Aug. 9, 1918 (since demobilised). B. C. S. Byrne; Jan. 22, 1919 (since granted short service commn.); L. W. C. Pearce since demobilised), G. Roberts (since demobilised); May 8, 1919. S. C. Garner; June 21, 1919. A. J. McQueen; July 10, 1919. Pilot Officer H. S. Lindfield (O.) to be Obs. Officer; Aug. 27, 1919.

Pilot Officers to be Flying Officers:—C. H. Bridge (late P.F.O.); Oct. 12, 1919 (since demobilised); C. H. Billings; Oct. 24, 1919 (since granted short service commn.).

The following relinquish their temp. R.A.F. commns. on return to Army duty:—Lieut. J. P. Shaver (Lieut., Can. A.S.C.); Feb. 8, 1919. Lieut. A. C. Malloch (Lieut., Can. Eng.); Feb. 14, 1919. Flying Officer E. L. Edwards (Lieut., Welsh R.); Feb. 5. Flying Officer (Hon. Flight Lieut.) L. N. Sutherland, A.F.C. (Capt., Bord. R.); Feb. 9.

The following relinquish their commns. on ceasing to be employed:—Lieut. J. R. Fuller; June 1, 1918. Lieut. F. G. Toy (Lieut., Aust. I.F.); April 3, 1919. Sec. Lieut. R. Harper (and is permitted to retain his rank); July 11, 1919. Lieut. E. T. Shand (Lieut. N. Zeal. Exped. Fs.); Feb. 2.

(Then follow the names of 39 officers who are transfd. to the Unemployed List under various dates.)

Capt. F. D. Holder, M.C. (Lieut., E. Kent R.), resigns his commn.; Feb. 14.

The following Lieuts. relinquish their commns. on account of ill-health, and are permitted to retain their rank:—E. J. Finch (Lond. R., T.F.); Aug. 15, 1919. G. F. Spaulding; Feb. 7.

Lieut. C. T. Black (Lieut., R. War. R.) resigns his commn.; Feb. 14.

Sec Lieut. D. C. Fuller relinquishes his commn. on account of ill-health contracted on active service, and is permitted to retain his rank; Feb. 6.

The surname of H. H. Bracher is as now described and not H. H. Brasche, as stated in the *Gazette* of July 30, 1918 (page 9014).

The surname of Sec. Lieut. J. E. Hermon is as now described, and not as stated in the *Gazette* of Oct. 21, 1919.

The Christian names of Alfred Horace Broom are as now described, and not Alfred Broom Broom, as stated in the *Gazette* of Oct. 22, 1918 (page 12494).

The notification in the *Gazette* of Nov. 18, 1919, concerning H. H. Bracher is cancelled.

The notification in the *Gazette* of Aug. 15, 1919, concerning Capt. L. H. F. Irving is cancelled.

The notification in the *Gazette* of Sept 12, 1919, concerning Sec. Lieut. R. Harper is cancelled.

The notification in the *Gazette* of Aug. 15, 1919, concerning Sec. Lieut. E. J. Finch is cancelled.

Administrative Branch

Pilot Officer (actg. Flight-Lieut.) W. Rollinson to be Flying Officer; Feb. 1, and to retain the actg. rank of Flight-Lieut. whilst employed as Flight-Lieut.

Pilot Officers to be Flying Officers:—A. J. Litton; Oct. 1, 1919. E. Maffey; Jan. 22.

(Then follow the names of 18 officers who are transfd. to the Unemployed List under various dates.)

Lieut. F. W. Avison (Midd'x R., S.R.) is cashiered by sentence of General Court-Martial; Nov. 17, 1919.

The surname of Sec. Lieut. E. J. Syer is as now described, and not as stated in *Gazette* March 25, 1919.

The notification in *Gazette* April 8, 1919, concerning Lieut. J. W. New is cancelled.

Technical Branch

Sec. Lieut. F. B. Reed to be Lieut., Grade (B); Jan. 27, 1919 (since demobilised).

Pilot Officer W. E. E. Stephens to be Flying Officer, Grade (A.); Jan. 3.

Sec. Lieut. E. J. Harding to be Lieut., without pay and allowances of that rank; June 1, 1919 (since demobilised).

Lieut. F. P. Cleaver (Lieut., R.F.A.) relinquishes his temp. R.A.F. commn. on return to Army duty; Jan. 30 1919.

(Then follow the names of 23 officers who are transfd. to the Unemployed List under various dates.)

Sec. Lieut. J. F. A. Klapper relinquishes his commn. on account of ill-health contracted on active service, and is permitted to retain his rank; Feb. 2 (substituted for notification in *Gazette* Feb. 3).

The notification in *Gazette* Nov. 18, 1919, concerning Sec. Lieut. (Hon. Lieut.) J. J. Galvin is cancelled.

The notification in *Gazette* Jan. 16 concerning Capt. J. J. Galvin is cancelled.

The notification in *Gazette* April 1, 1919, concerning Lieut. R. R. Macgregor is cancelled.

Medical Branch

Flying Officers to be Flight-Lieutenants:—T. Montgomery; Aug. 19, 1919. C. F. Eminson; Feb. 1. R. D. Jones; Feb. 6.

(Two officers transfd. to the Unemployed List.)

Memoranda

The following Lieutenants are granted the hon. rank of Capt.:—A. N. Greg; Jan. 15, 1919. W. Batcheldor; April 4, 1919.

(Then follow the names of 8 Prob. Flight Officers who are granted hon. commns. as Sec. Lieuts.).

Aerial Lighthouse at Le Bourget

THE Air Ministry announces that the following Notice to Airmen No. 15 has been issued:—

For the purpose of assisting pilots on the London-Paris air route a flashing lighthouse is now installed at Le Bourget aerodrome, seven miles N.E. of Paris. This lighthouse is in operation every evening from 4.30 to 7.30, and later if required. The signal flashed is the Morse signal "N" or "dash-dot" at short intervals. The lighthouse is situated at the south side of the aerodrome.

Cricklewood Aerodrome Open for Continental Traffic

THE Cricklewood aerodrome was officially opened on Tuesday as the departure and arrival aerodrome for the Handley Page commercial aeroplanes operating between London, Brussels and Paris.

H.P. Paris and Brussels Air Services

ON the Handley Page Continental air services between September 2, 1919, and February 12, 1920, 943 passengers and 44,095 lbs. of freight have been carried over a distance of 67,543 miles.

The London-Paris Airway

ALTHOUGH their 150 flying days have included such adverse conditions, with mist and fog, as are encountered in November, December and January, the Airco aerial postmen—making their journeys to time on Saturday between Paris and London—have now, since August 25, 1919, when the "air express" service started, completed 293 of their 358 scheduled flights. The total mileage of the Airco pilots is now 70,065, and their speed through all weathers has usually exceeded, and has never fallen below, 100 miles an hour. This enables an air-mail letter which is posted in London at 11 a.m. to be delivered in Paris by 4 p.m. the same afternoon, even although, as is still the case, 2¾ hours of this total of five hours are exhausted in land collections and deliveries.

London-Prague Flight

WORD came from Prague, on February 15, that an Airco aeroplane, piloted by Lieut. McMullin, arrived there from London, in connection with the negotiations between the Czecho-Slovak Government and a British firm which is seeking to organise an aerial service in Bohemia. The flight, which was made *via* Brussels and Berlin, took 10 hrs. 20 min., including a stop at Berlin for petrol. The trip from Berlin to Prague was accomplished in 2 hrs. 20 min.

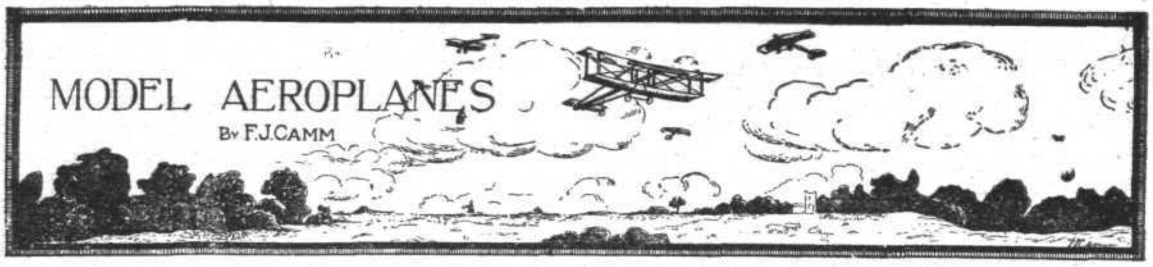
Lieut. McMullin reports that, alighting in Germany for adjustments, he found himself in a field surrounded by telegraph wires, from which it appeared difficult to ascend. He explained his predicament to the German officials, who had a line of telegraph poles taken up so that the aeroplane might get away safely. The bill presented to the pilot for this lengthy piece of work, on which a number of men were engaged, was 150 marks, the equivalent at present rate of about 15s.

Sir Ross Smith Reaches Sydney

HAVING effected the necessary repairs to his Vickers-Vimy-Rolls, Sir Ross Smith and his companions set out from Charleville on February 13 to complete their journey across Australia. They arrived at Bourke, a stage of 225 miles, and the next day flew the remaining 400 miles to Sydney. Sir Ross Smith, his brother, Sir Keith Smith, and Sergts. Shiers and Bennett were given a very enthusiastic welcome. They hoped to fly on to Melbourne later.

To Fly Round the World

FROM a message to hand from Sydney, it would appear that Messrs. Vickers have offered to Sir Ross Smith the chance to fly round the world in a seaplane. Sir Ross Smith has not yet decided whether he will accept this offer, but he thinks the feat might be accomplished in 70 days.



NOTE.—*All communications should be addressed to the Model Editor.*

A Simple Monoplane

A READER who has recently taken up model aeroplaning has asked for details of a simple model to commence with, and while I do not wish to devote too much space to the "flying stick" type, there are possibly many readers in a similar position to this correspondent, who have not access to what has gone before, and I therefore show drawings of a

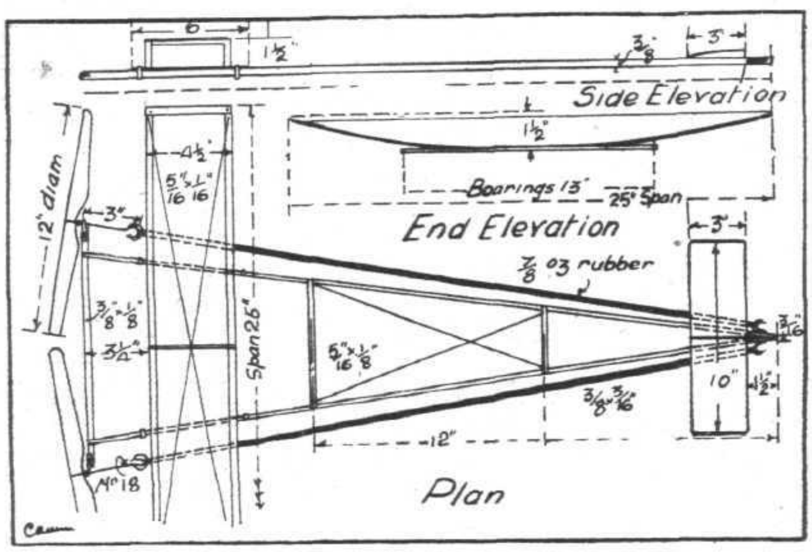


Fig. 1

simple twin-screw A frame monoplane, similar to the type originated by Twining. I consider twin-screw models are essential for tyros, as enigmatical torque troubles are eliminated.

In the machine shown birch is used for the frame, and spruce for the plane. The elevator is formed from 18-gauge piano-wire, the fabric being sewn to the frame. The complete dimensions are given on the drawing (Fig. 1), from which the construction will also be clear.

Useful Formulæ

THE ratio of the weight of a model aeroplane to the thrust required to fly it is about 1·5. The thrust can be determined from the formula—

$$T = \frac{t\,A}{R}$$

where T = thrust;
t = torque at shaft in mch. ounces;
A = angle at propeller tip.

Weight of a rubber-driven model *fuselage* should not exceed ¼ oz. per ft.

Loading should not be more than 8 ozs. per sq. ft., nor less than 4 ozs. per sq. ft.

1,000 cub. ft. of hydrogen lift from 70 to 80 lbs., according to the purity of it.

Thrust may also be computed from the following formula:—

$$\text{Thrust} = \frac{\text{h.p.} \times 33{,}000}{\text{Pitch} \times \text{r.p.m.}}$$

Varnished silk weighs from ·012 to ·039 lb. per sq. ft.

$$\text{Pitch} = 3\frac{1}{7} \times \text{diam.} \times \tan A$$

where tan A = tangent of pitch angle.

Finding Pitch of Propeller given size material available.—The following method of calculating the pitch of any propeller that can be made from a given block of wood will be found useful. The formula is $3\frac{1}{7}''$ × diam. × thickness of block × width of block inverted. For example, we have a rectangular block of wood 12 × ¾ × 1½ ins., therefore the pitch of the propeller which can be cut from that block will be—

$$\frac{22}{7} \times \frac{12}{1} \times \frac{3}{4} \times \frac{2}{3} = \frac{132}{7} = 18\frac{6}{7} \text{ inches} = \text{pitch.}$$

Care of Rubber.—Rubber, which is used more extensively as a motive-power for model aeroplanes than any other power, is exceedingly susceptible to the action of grease, and as a lubricant must be used, in order to secure the maximum amount of power and longest possible duration of flight, care should be exercised with regard to the composition of it. It is essential that one of the constituents of the lubricant be soft soap. Only the purest quality should be used, as the cheaper brands contain acids, alkalines, and fats which have the deleterious effect of rendering the rubber "sticky" within a few hours of application, and hence causing it to perish. The best lubricant of which we know is constituted as follows:—

Pure soft soap	70 per cent.
Pure glycerine	10 per cent.
Water	19 per cent.
Salicylic acid	1 per cent.

This compound should be brought to ebullition, adding the acid when this point is reached.

The width of a propeller blade should be from one-eighth to one-twelfth of the diameter. The pitch for single-screw machines should never exceed three times the diameter, when the pitch will be nearly 45°. The pitch angle for twin-screw should not exceed 50°. Beyond these limits the screw begins to lose efficiency.

Tractor Biplane Details

I SHOW in Fig. 2 some details of construction of a tractor biplane. Such construction I have

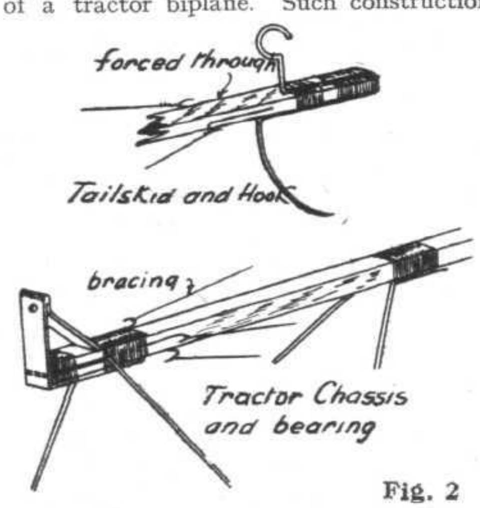


Fig. 2

employed on nearly all my tractor models, and have proved more satisfactory than other methods. In the detail of the chassis it will be seen that this passes round the end of the main spar *inside* the bracketed bearing. The chassis, therefore, need only be made in two pieces, namely, the V side members and the wheel axle.

The rubber hook and tailskid also follows round the trailing end of the spar, and is similarly formed from a single length of wire. A neat longitudinal adjustment for tractor biplanes is shown by Fig. 3, where two blocks tightly saddle the spar,

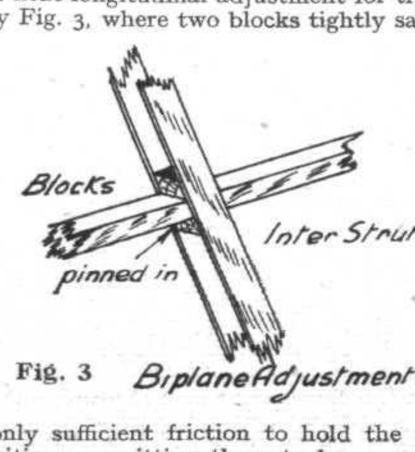


Fig. 3 Biplane Adjustment

yet with only sufficient friction to hold the planes in any desired position, permitting them to be moved along when it is required so to do. Two central inter-struts are used, one on each side of the spar.

SIDE-WINDS

THE joy-riding season is already showing signs of commencing, and many applications are being received for flights in the Handley Page commercial aeroplanes between Cricklewood and Hounslow, when the machines travel to the latter aerodrome to pick up passengers and cargo for the Continent. Seven passengers carried out this trip on February 12. The charge is 30s., and it is one of the cheapest methods of obtaining a unique view of London from the air.

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SOUTH AFRICA has an Aerial Transport Co., and one of its novel commissions was to carry Capt. George C. Cullum, D.S.O., the Durban manager of the Dunlop Rubber Co., on a business trip over part of the colony. Piloted by Maj. Miller, D.S.O., who gained considerable experience during the War, a Natalia aeroplane flew from Durban along the coast to Port Shepstone, then inland across the Ingoli Mountains to Kokstad; Matatiele was next visited, and, skirting the Drakenberg Range, the machine passed over the Swartzberg Mountains to Maritzburg. The total distance covered was roughly 450 miles. Everywhere the travellers were enthusiastically received. At all the towns they were publicly welcomed by the mayor and town councils; interviewed by all the papers—one of which issued a special souvenir—and entertained to a complimentary dinner to signalise the arrival of the first aeroplane at Kokstad and East Griqualand. At Kokstad the whole of the business premises, post office, etc., were closed entirely on the day the Natalia arrived. Very much the same procedure was followed at Matatiele, almost the entire population for miles round coming in to catch their first glimpse of a flying machine.

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THE Vacuum Oil Co., Ltd., advise us that a new price list came into effect on February 11.

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SOME little time ago we noticed an admirable little *brochure*, "The History of Castrol," published by Messrs. C. C. Wakefield and Co. By way of a supplement to that, the firm have now produced another booklet, "The Australian Flight," giving a *résumé* of the flight of Sir Ross Smith on his Vickers-Vimy-Rolls from London to Australia, during which trip "Castrol R" was relied upon to lubricate the engines.

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SOME facility with regard to the opening of credits abroad for payment of goods to be imported into Greece has been afforded by the following Government regulation :—"Merchants able to produce a certificate from the Financial Inspector of their district proving that they have been recognised as engaged in business for the period of two years up to date, are no longer called upon to deposit guarantee in cash. In lieu thereof the Government accept the merchant's personal guarantee for 40 per cent. of the value of the credit opened." Commercial circles in Greece have welcomed this innovation, and hope that still greater facilities will shortly be granted to importers from foreign countries.

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PARROT cries of "Get going, get going" and "Produce, produce" are ever in our ears from Governmental quarters. Yet obstruction on the top of obstruction appears to be the guiding principle of bureaucracy whenever Dora gives them, under its ramping clauses, the slightest opening to "carry on" and thereby make a show of justifying the continuance of their job. Something drastic in this holding-up game appears to be happening over the Whitehead aeroplane factories, and freeholds, which it is proposed to swamp under the Dora penalising clauses. Thus is prevented the "getting going" for large mass production of Whitehead motor cars, for which the whole organisation is ready at hand for, under efficient management, carrying through. Mr. Whitehead, who is straining to "produce" under the new conditions at the earliest possible moment, has, we understand, his plans well forward for giving a hand, by mass car-production, in helping to re-establish normal commercial conditions, and we hope to hear shortly that he has been enabled to carry through his scheme whereby great activities upon the lines indicated will soon be in operation at both the Richmond and Whitehead Park works, Feltham. Mass car-production should be a good stand-by against the time the aviation boom breaks out presently in earnest.

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THAT Avro house-organ, *The Joystick*, in its appropriately cerulean blue cover, still merrily keeps its monthly course, now totting up into its fifth volume. Throughout it reflects the happy conditions which prevail under this organisation. With the current February number the new features introduced for 1920 are continued. A charming sepia portrait on plate paper of Mr. Walter Fenton is a striking "inset" and the general make-up and character of the little publication entitle it to a place beyond the necessarily limited circle of a firm's house-organ. Much of its contents appeal to readers quite outside the Avro surroundings. Although the serious side is well catered for, the humorous side is quite a feature. We always look forward to the *Joystick's* monthly visit.

Lectures on Aviation

SIR RICHARD GLAZEBROOK, K.C.B., F.R.S., the Zaharoff Professor of Aviation in the University of London, will give a course of introductory lectures at the Imperial College of Science on Wednesdays, at 5 p.m., commencing on Wednesday, February 25, on the following subjects :—February 25 : "Aeronautical Research : Models and Full Scale" ; March 3 : "Stability and its Investigation" ; March 10 : "Instruments and Methods of Full-scale Research" ; March 17 : "Strength of Construction : Factor of Safety" ; March 24 : "The Airscrew—its Design and Efficiency." The lectures are free and open to persons interested, both students of the College and others. Applications for tickets of admission should be made to the Registrar of the Imperial College of Science and Technology, South Kensington, S.W. 7.

The Wireless Society of London

THE next meeting of the society will be held on February 27, at 8 p.m., in the lecture hall of the Royal Society of Arts. Mr. Alan A. Campbell Swinton, F.R.S., the President, will deliver his annual address, taking as his subject "Some Wireless Wonders." A number of experiments will be carried out, and during the evening it is hoped to receive and record in view of the audience a special message to the Society from Gen. Ferrie of the Eiffel Tower in Paris. No outside aerial will be used, the signals being received on the apparatus used in the room. In the afternoon of the same day a conference of provincial wireless societies which have recently become affiliated to the Wireless Society of London, will be held at 3 p.m., also at the Royal Society of Arts.

British Achievement in Argentina

MAJOR KINGSLEY, late of the Royal Air Force, has completed 10,000 miles in demonstration flights in a single Airco machine, having maintained an average speed of 105 m.p.h., says a message from the *Times* correspondent at Buenos Aires.

To Lyons Fair by Air

IT is fitting that those who wish to visit the Lyons Fair should have the opportunity of making the journey by air. Beginning on February 27, a daily passenger service by aeroplane will be run between London and Lyons, and will continue for the period of the Fair.

Swedish Air Mail Service

BACKED up by a recommendation from the Swedish Post Office Department, the request of the Swedish Air Traffic Co. for a State loan of two million kroner (£111,111) is now being considered by the Government in Stockholm. The Department urges that air traffic, especially the carrying of mails between Sweden and foreign countries, is very desirable, and that, if the State does not consent to the scheme, it must reckon upon being soon pushed aside by the competition of foreign countries.

An Italian Airship Service

A SERVICE of airships is to be started shortly between Italy and Tripoli, under the management of the Grutter firm. The first starting points will be Naples and Palermo.

The Rome–Tokyo Flight

THE 450 h.p. Caproni biplane, piloted by Lieut. Negrini and Lieut. Origgi, arrived at Smyrna from Salonika on February 13.

The 600 h.p. Caproni, piloted by Lieut. Salla and Borello, flew from Salonika to Smyrna on February 10.

Two S.V.A. aeroplanes, piloted by Lieuts. Ferrarin and Masiero, left the Centocelle aerodrome, Rome, on February 14, to fly to Tokyo.

A German Height Record

UNDER the regulations of the Federation Aeronautique Internationale, the German Aviation Committee has homologated the height record made by Lieut. Martins with a passenger on a Hawa F6 D84, on October 22, as 7,960 metres. The height above sea level was stated to be 8,430 metres.

Miss Douglas-Pennant's Charges

IN the King's Bench Division on February 11 the Lord Chief Justice heard the libel action brought by Mr. Walter Charles Bersey, an underwriter at Lloyd's, formerly a Lieut.-Col. in the Royal Air Force, employed in the Women's Air Force, against the Hon. Violet Douglas-Pennant, a National Insurance Commissioner for Wales, who was formerly a commandant in the Women's Royal Air Force. The libel was in two letters written by her. One of the letters was written to Mr. Lloyd George, on September 2, 1918, and another to Mr. Winston Churchill on May 3, 1919.

In summing up, his lordship said that no charge so far as this action was concerned, was made against the plaintiff. The defendant, since 1911, had held a high position, which she had filled with credit. The only issue put upon the record was privilege, and that issue was to be dealt with by himself in law, and by the jury in fact.

The jury found for the plaintiff £200 damages and judgment for that sum was entered with costs.

On the following day the case in which Brig.-Gen. Livingston sued the Hon. Violet Douglas-Pennant for libel was entered but it was stated that the parties had come to terms. The Lord Chief Justice said the parties had taken the proper course and there would be judgment for the plaintiff for £200 with costs.

The Clerget Engine Claim

THE claim of Messrs. Gwynne (Limited), of Hammersmith, in respect of the Clerget aeroplane engine was before the Inventions Commission on Monday, Mr. Justice Sargant presiding. Two engines, a Clerget and a Bentley, were set up in the room where the commission sat.

The claim also related to the B.R. 1 and the B.R. 2 engines, about which a claim had been made by Capt. Bentley.

Sir Cassie Holden, for the claimants, contended that 80 per cent. of the Clerget engine was of true Clerget design, and, consequently, the claimants were entitled to a royalty based on 80 per cent. of the spares ordered.

Major George Urquhart, of the Liquidation of Aircraft Contracts Committee, said the Clerget engine was used in every theatre of the war, and 3,997 were made in England.

Mr. Trevor Watson, for the Crown, said if the commission were of opinion that the agreement for a 10 per cent. royalty up to a maximum of £75,000, for the Clerget engine was a fair one in the circumstances, he would not suggest for a moment that all that was due should not be paid. He suggested a lump sum award instead of payment on a royalty basis. In regard to the B.R. 1 and B.R. 2 he contended that there should be an initial lump sum payment, and that it should not exceed £5,000.

Sir Cassie Holden undertook that no claim should be made against the Government by Messrs. Clerget.

The chairman announced that the commission would consider its award.

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PUBLICATIONS RECEIVED

Date Card and Calendar, 1920—"*The Transatlantic Aeroplane.*" Vickers, Ltd., Aviation Department, Vickers House, Broadway, Westminster, S.W. 1.

The Romance of Aircraft. By Laurence Yard Smith. London: Grant Richards, Ltd. Price 10*s*. 6*d*. net.

Report No. 67. *Supplies and Productions of Aircraft Woods.* The National Advisory Committee for Aeronautics, Washington, D.C., U.S.A.

The Log of an Aeromarine. Aeromarine Plane and Motor Co., Keyport, New Jersey, U.S.A.

The British Dominions Year Book, 1920. The Eagle, Star and British Dominions Insurance Co., Ltd., Royal Exchange Avenue, E.C. 3. Price 1*s*.

Airman's International Dictionary. By M. M. Dander. London: Charles Griffin and Co., Ltd. Price 6*s*. net.

Report No. 66. *Glues Used in Airplane Parts.* National Advisory Committee for Aeronautics, 4th Street and Missouri Avenue, N.W., Washington, D.C., U.S.A.

Catalogues

The "Imperial" Motor and Aircraft Accessories. G. Davenport and Co., Ltd., 101-105, Clerkenwell Road, London, E.C. 1.

Castings. Haywood Foundries, Ltd., 30-32, Seaton Street, Euston Road, London, N.W. 1.

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Index and Title Page for Vol. XI

The 8-page Index for Vol. XI of "FLIGHT" (January to December, 1919) is now ready, and can be obtained from the Publishers, 36, Great Queen Street, Kingsway, W.C. 2. Price 1*s*. 2*d*. per copy, post free.

COMPANY MATTERS

British Cellulose and Chemical Manufacturing Co., Ltd.

IT is announced that owing to the necessity of a long absence in Canada, Colonel W. Grant Morden, M.P., has retired from the chairmanship and board of the British Cellulose and Chemical Manufacturing Co., Ltd., and Sir Harry McGowan, K.B.E., has been elected chairman of the board.

Sir Philip G. Henriques, K.B.E., and Brig.-Gen. William Alexander, C.B., C.M.G., have become directors, representing His Majesty's Government, and the following gentlemen have been added to the board:—Sir John Field Beale, K.B.E., Sir Henry Birchenough, Bt., K.C.M.G., and Mr. Arthur Chamberlain.

Rolls-Royce, Ltd.

THE report to be presented to the shareholders at the thirteenth ordinary general meeting on February 20, states that the directors have nothing further to add to their recent report to the shareholders on the general position of the company. The balance-sheet for the year ended October 31, 1919, is not yet ready for presentation, but the directors are confident that the profits justify the declaring of a dividend of 15 per cent. (subject to income tax), which they accordingly recommend.

NEW COMPANY REGISTERED

ORIENTAL MERCANTILE AIR NAVIGATION, LTD.—Capital £225,000, in £1 shares. Manufacturers of and dealers in aircraft, etc. Under agreement with the I.A.C. Syndicate, Ltd. Directors: A. M. Barnes, J. A. Gant, J. W. Jones and J. W. V. Hoytema.

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AERONAUTICAL PATENTS PUBLISHED

Abbreviations:—cyl. = cylinder; I.C. = internal combustion; m. = motors

APPLIED FOR IN 1919

The numbers in brackets are those under which the Specifications will be printed and abridged, etc.

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232. M. JAFFEE. Aeroplanes. (137,888.)
1,590. A. W. P. TEWKESBURY. Instruments for indicating angle of flight. (137,910.)
10,019. P. M. J. R. C. C. G. MALSALLEZ. Landing-apparatus. (137,974.)
10,703. J. G. AMBROSE. Aircraft. (133,017.)
10,871. H. L. M. BENARD. Flash-lights for aerial navigation. (137,981.)
13,469. F. H. PAGE. Aircraft struts. (138,006.)
18,562. A. H. HATHAWAY. Inclinometers. (138,031.)

If you require anything pertaining to aviation, study "FLIGHT'S" Buyers' Guide and Trade Directory, which appears in our advertisement pages each week (see pages xxxi, xxxii, xxxiii and xxxiv).

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